EXTRA

FINAL REPORT

Dingell-Johnson Project F-1-R-38

Study I-7

A STUDY OF THE LIFE HISTORY AND MANAGEMENT OF THE CRAPPIE: SAMPLING AGE-0 CRAPPIE AND EVALUATING FACTORS THAT MIGHT AFFECT RECRUITMENT IN MISSOURI'S LARGE RESERVOIRS

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ABSTRACT

Studies of age-0 white crappie in five Missouri reservoirs indicate that factors which affect mortality are complex, and management practices to improve recruitment are currently limited. White crappie year-class strength, as determined from an age group's estimated harvest, was highly variable. Annual fluctuations were not predictable within a reservoir nor synchronous between reservoirs. Sampling of age-0 crappie with a meter net from May through early June on the Long Creek and James River arms of Table Rock Lake and the Niangua Arm of Lake of the Ozarks indicated that mortality patterns of larval crappie were also highly variable.

With few exceptions, sampling of age-0 crappie using three capture methods (meter net in June, mid-water trawl in September, and trap nets in October) did not reveal a consistent, significant correlation between capture rates and year-class strength. The exceptions--cases where age-0 capture rates predicted year-class strength--were: 1) meter-net capture rates of larvae 12 mm and longer in one location (the James River Arm of Table Rock Lake; 2) mid-water trawl capture rates in two locations (the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake); and 3) trap-net capture rates in three locations (the Niangua Arm of Lake of the Ozarks, Pomme de Terre Lake, and the James River Arm of Table Rock Lake). None of the sampling methods predicted year-class strength in two locations (the Sac Arm of Stockton Lake and Wappapello Lake). Although no statistical relationship could be established, extremely high meter-net capture rates of 1,000 or more larvae per 1,000 m^3 of water were always associated with medium or large year classes.

Reservoir water level, inflow, and outflow were not significantly correlated to crappie year-class strength or to meter-net capture rates on any of the reservoirs.

Comparison of year-class strength with crappie stock parameters showed that both the estimated densities of immature crappie and of all white crappie were inversely related

to year-class strength in one location (the Niangua Arm of Lake of the Ozarks), but not on any of the other reservoirs tested.

A study of larval distribution between a spawning cove and main lake pelagic area on the Long Creek Arm of Table Rock Lake revealed that two measurements--density of all larval crappie and the percentage of larvae less than 6 mm long--were significantly higher in the spawning cove.

Food habit studies on the James River Arm of Table Rock Lake showed that crappie larvae less than 6 mm long ate primarily copepod nauplii and copepodids, and larger larvae ate copepodids and cladocerans. It was difficult to determine if food for small crappie larvae was a limiting factor during the years examined (1982-1985) because few empty stomachs were encountered and there did not appear to be major changes in consumption from year to year.

Future studies of crappie recruitment should concentrate on one or two reservoirs, where the factors that affect the recruitment of several important species could be examined simultaneously.

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INTRODUCTION

Crappie are extremely popular sport fish in large reservoirs of the central and southern United States and rank number one in weight harvested (Jenkins and Morais 1971). Fishing pressure for crappies may constitute over half of the total in some large Missouri reservoirs. Unfortunately, many of these fisheries have extreme fluctuations in year-class strength that affect the quality of fishing from year to year (e.g. Starrett and Fritz 1965; Bross 1969; Siefert 1969; Mitzner 1981; Colvin and Vasey 1986; Harper and Nammingo 1986). A single poor year class affects anglers in later years when densities of harvestable crappies decrease, and two or three consecutive years of poor recruitment can temporarily devastate a fishery.

Factors related to the fluctuations in recruitment of crappies are varied and not well understood. Bennett (1944) and Swingle and Swingle (1967) postulated that high densities of age I and II crappies inhibit reproduction or survival of young-of-the-year; therefore, large year classes should be produced every three to five years after densities of older crappie have been reduced through natural or fishing mortality. Mitzner (1981) found a positive relationship between floodwater storage and crappie recruitment in Lake Rathbun, Iowa. Changes in reservoir water levels may influence recruitment by affecting the production of zooplankton that age-0 fish need for food.

Year-class strength is often determined early in the first year of life (Blaxter 1969; Bagenal and Braum 1971). Determining year-class strength and factors that affect it early in a cohort's life would improve the likelihood of developing effective management techniques. However, predicting year-class strength based upon larval catches is often difficult (Snyder 1983).

The objective of this study was to identify important factors affecting recruitment of white crappie (Pomoxis annularis) in Missouri's large reservoirs. Since little information

about the early life history of crappie existed when this study began in 1968, some early efforts were directed at obtaining basic information on larval distribution and mortality. The first part of this report addresses these questions:

1. How variable are crappie year classes in Missouri reservoirs and are the variations predictable or random?
2. What is the basic distribution of crappie larvae between a known spawning cove and adjacent main-lake pelagic areas?
3. What are the mortality patterns of age-0 crappie?
4. Can year-class strength be determined from catches of age-0 crappie?

Only white crappie are discussed in this report because they typically constitute over 95% of the total crappie community. The initial emphasis was on identifying critical periods of mortality by sampling age-0 crappie throughout their first year of life, using a mter net during the first few weeks and a mid-water trawl and trap nets thereafter. Standard reservoir creel surveys on 5 Missouri reservoirs were used to estimate the harvest and strength of each year class of white crappie. Year-class strength was then compared with capture rates of age-0 crappie obtained with each of the various sampling methods to determine if predictive models could be developed.

The second part of this paper examines three of the variables that we could quantify and that may be related to crappie recruitment:

1. reservoir water levels,
2. reservoir inflow and outflow, and
3. adult and juvenile crappie densities.

Recommendations for future research into factors that affect recruitment are made at the end of the paper and results of some initial analyses of larval crappie food habits are presented in Appendix G.

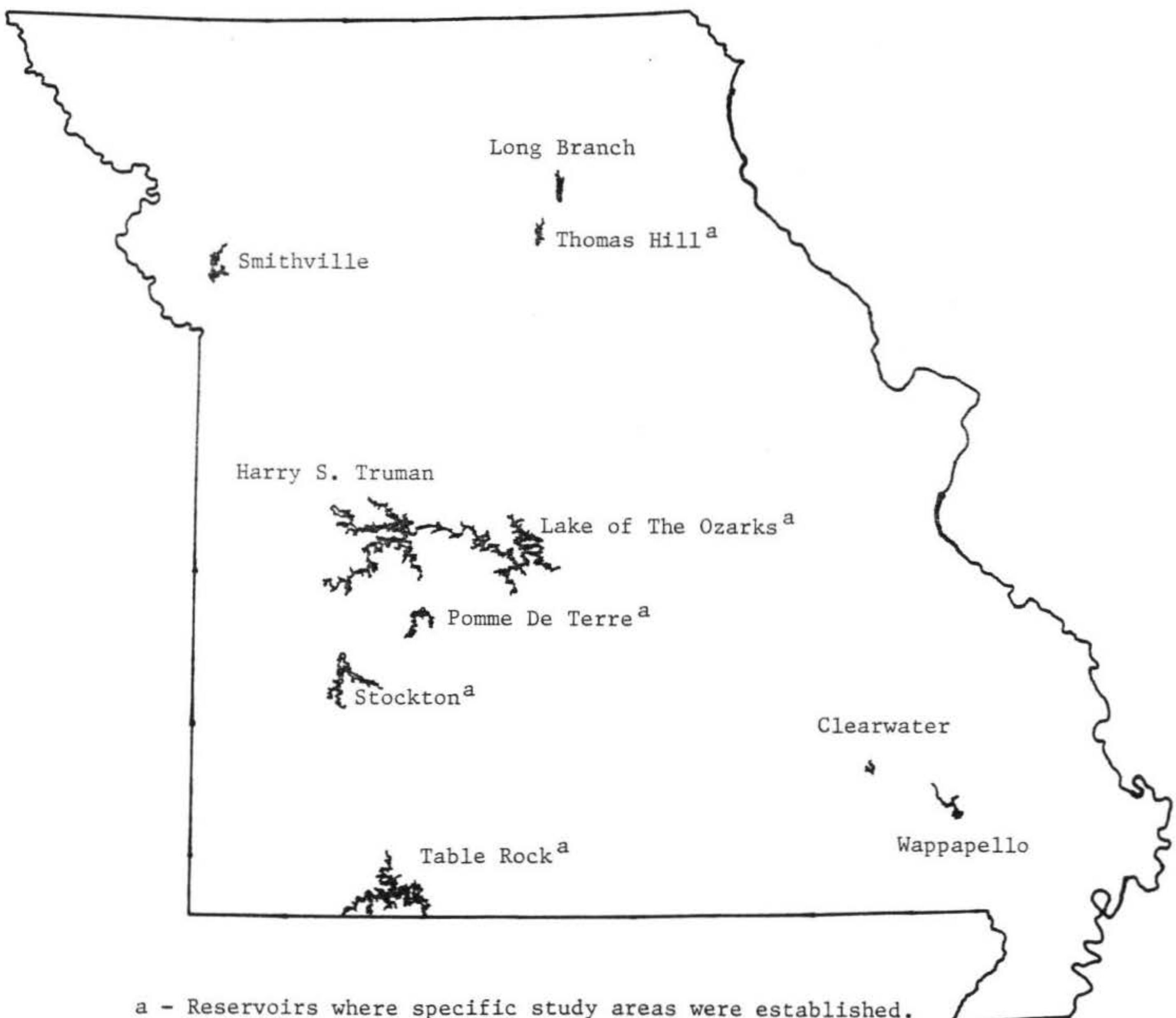
STUDY LAKES

Age-0 crappie were sampled on several large Missouri reservoirs (Table 1 and Figure 1). Sampling techniques with the meter net and mid-water trawl were developed on Table Rock Lake during the first few years of the study and by 1973 were expanded to several other major reservoirs. Specific study areas were selected on most reservoirs and coincided with creel survey areas where possible (Figures 2-7). Data from reservoirs where year-class strength could be estimated from creel surveys were used to analyze factors that affect recruitment. Such data were available for the Niangua Arm of Lake of the Ozarks, Pomme de Terre Lake, the Sac Arm of Stockton Lake, the James River Arm of Table Rock Lake, and Wappapello Lake. However, data from all reservoirs sampled during the study are given in the various appendices.

Table 1. Characteristics of Missouri reservoirs that were sampled by various methods to study fluctuations in white crappie year-class strength. (Year impounded is in parentheses. Only reservoirs that were sampled more than two years are included.)

Reservoir and Arm	Area(Ha) Conservation pool	Area(Ha) Flood pool	Area(Ha) Drainage (x 10^5)	Storage Ratio	Shore Development	Depth(m) Mean	Depth(m) Maximum	Spring Secchi (cm)
Lake of the Ozarks (1931)	22,500	---	36.2	0.28	38.0	10.4	33	
Niangua Arm	2,300	---	1.7	---	---	6.4	---	50-150
Pomme de Terre (1961)	3,200	6,500	1.6	0.71	9.1	9.4	27	80-200
Stockton (1970)	10,100	15,500	3.0	1.28	11.3	11.3	33	
Sac Arm	3,500	---	1.6	---	---	7.3	---	100-250
Table Rock (1958)	17,700	21,200	10.4	1.06	25.6	19.2	67	
James River Arm	4,000	---	3.3	---	---	12.0	---	40-120
Long Creek Arm	2,000	---	0.6	---	---	18.6	---	100-380
Thomas Hill (1965)	1,900	2,000	0.4	1.00	6.5	3.7	9	20-100
Wappapello (1941)	3,300	9,400	3.4	0.06	14.2	2.4	9	20-140
Clearwater (1948)	660	4,200	2.3	0.03	4.8	4.0	15	100-150

Figure 1. Missouri reservoirs where age-0 crappie were sampled.



a - Reservoirs where specific study areas were established.
See Figures 2 - 7.

Figure 2. Standard meter net and mid-water trawl areas that were sampled on the Niangua Arm of Lake of the Ozarks.

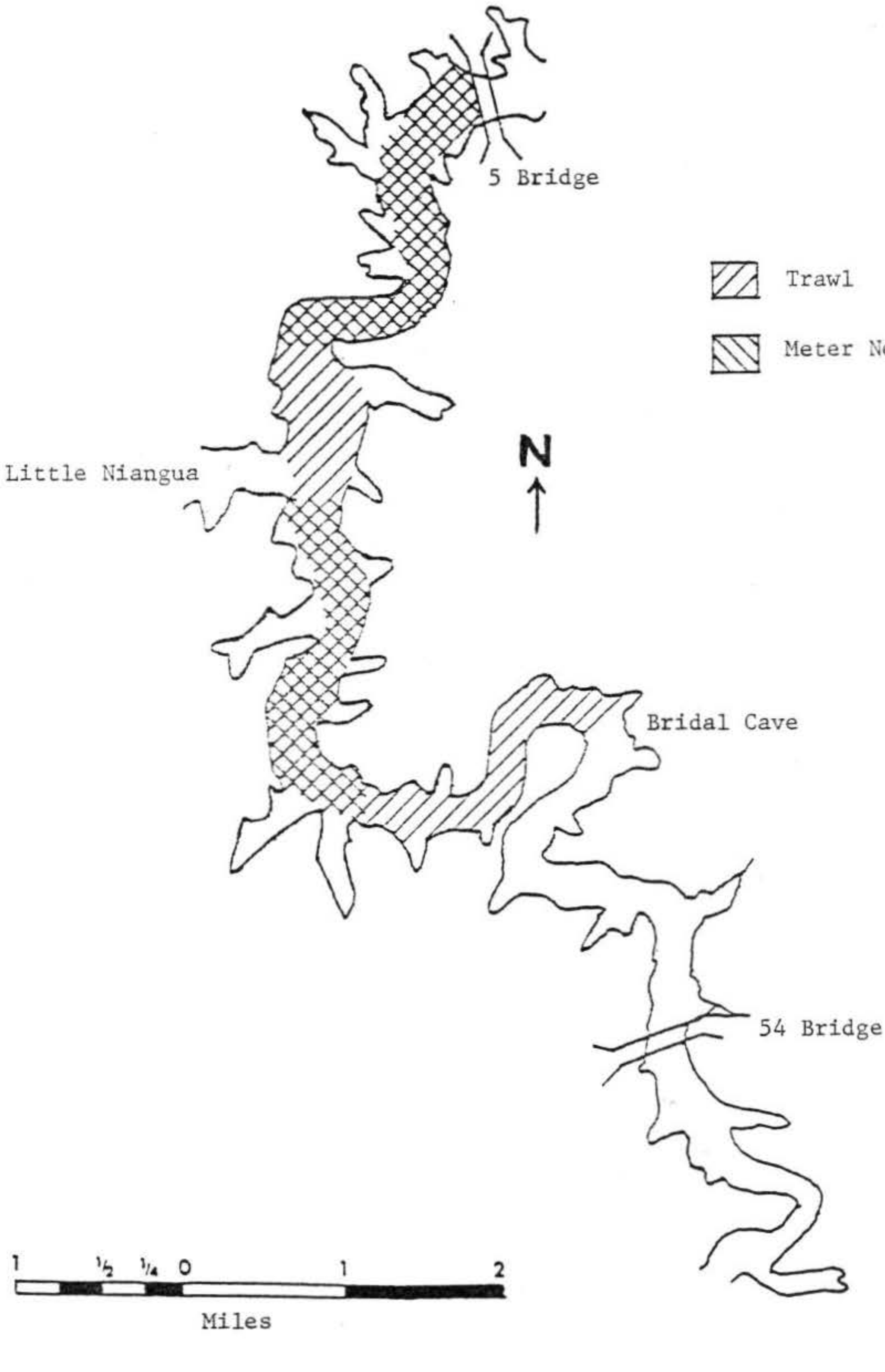


Figure 3. Standard meter net and mid-water trawl areas that were sampled on Pomme de Terre Lake.

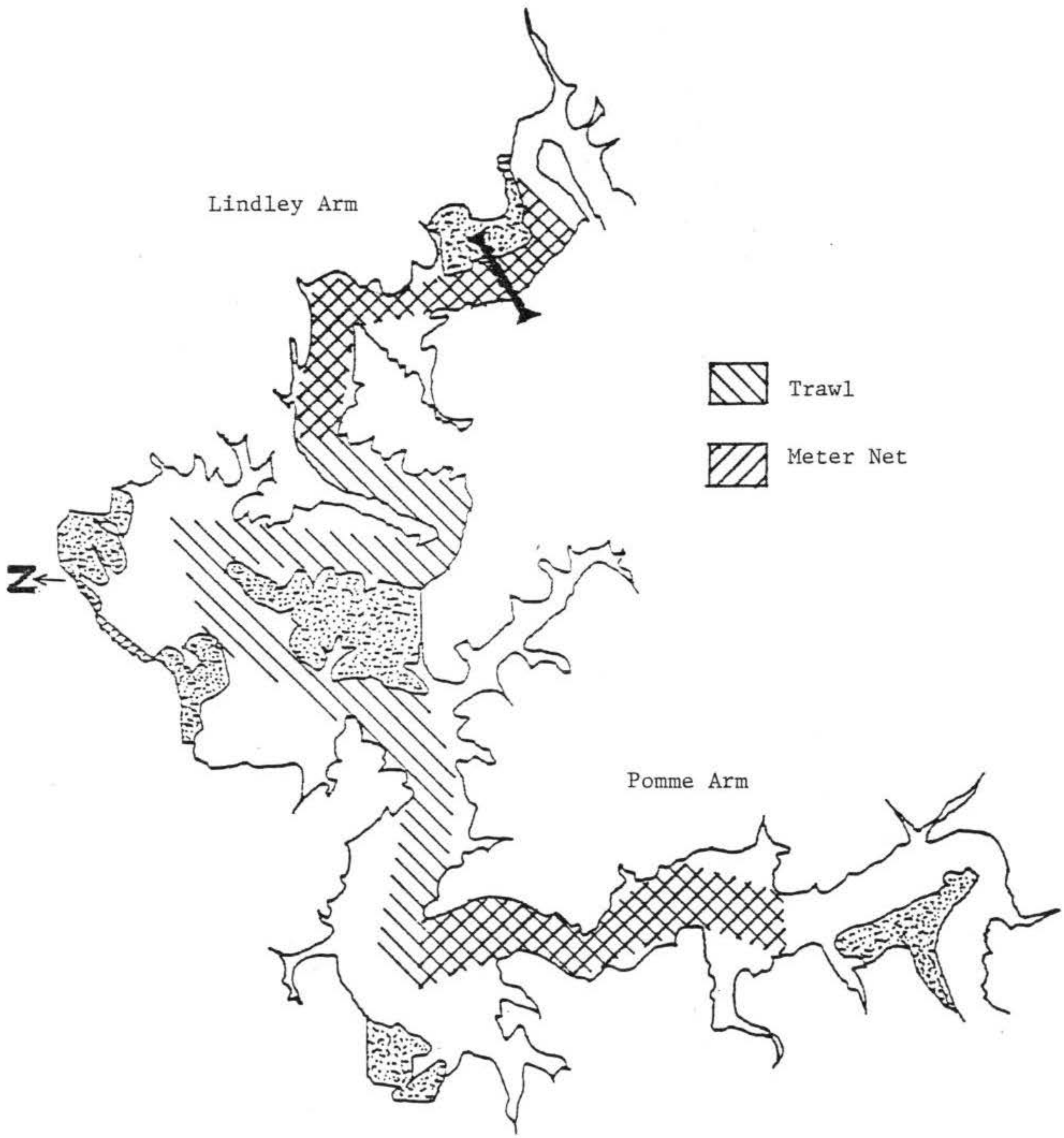


Figure 4. Standard meter net and mid-water trawl areas that were sampled on the Sac Arm of Stockton Lake.

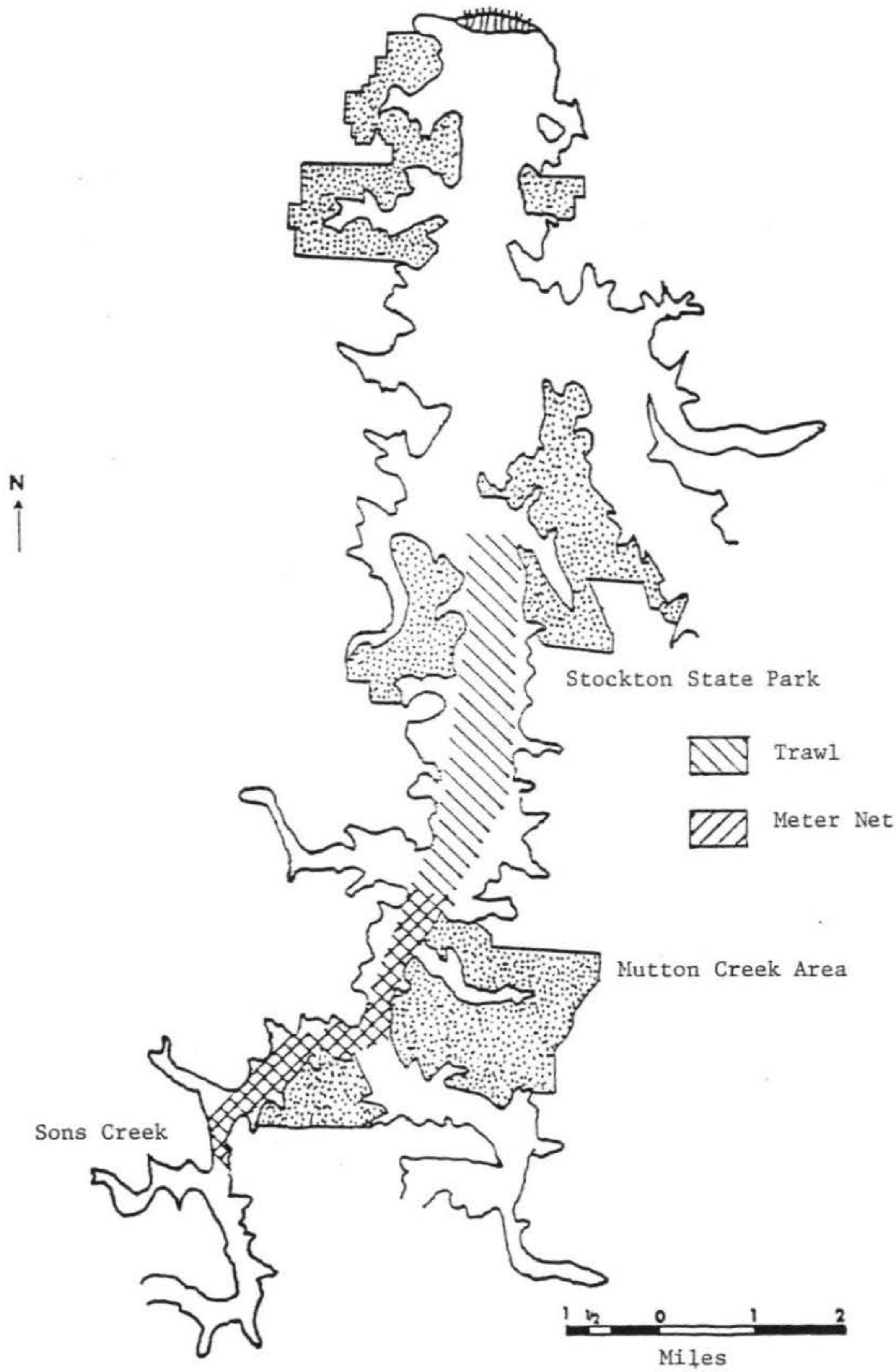


Figure 5. Standard meter net and mid-water trawl areas that were sampled on the James River Arm of Table Rock Lake.

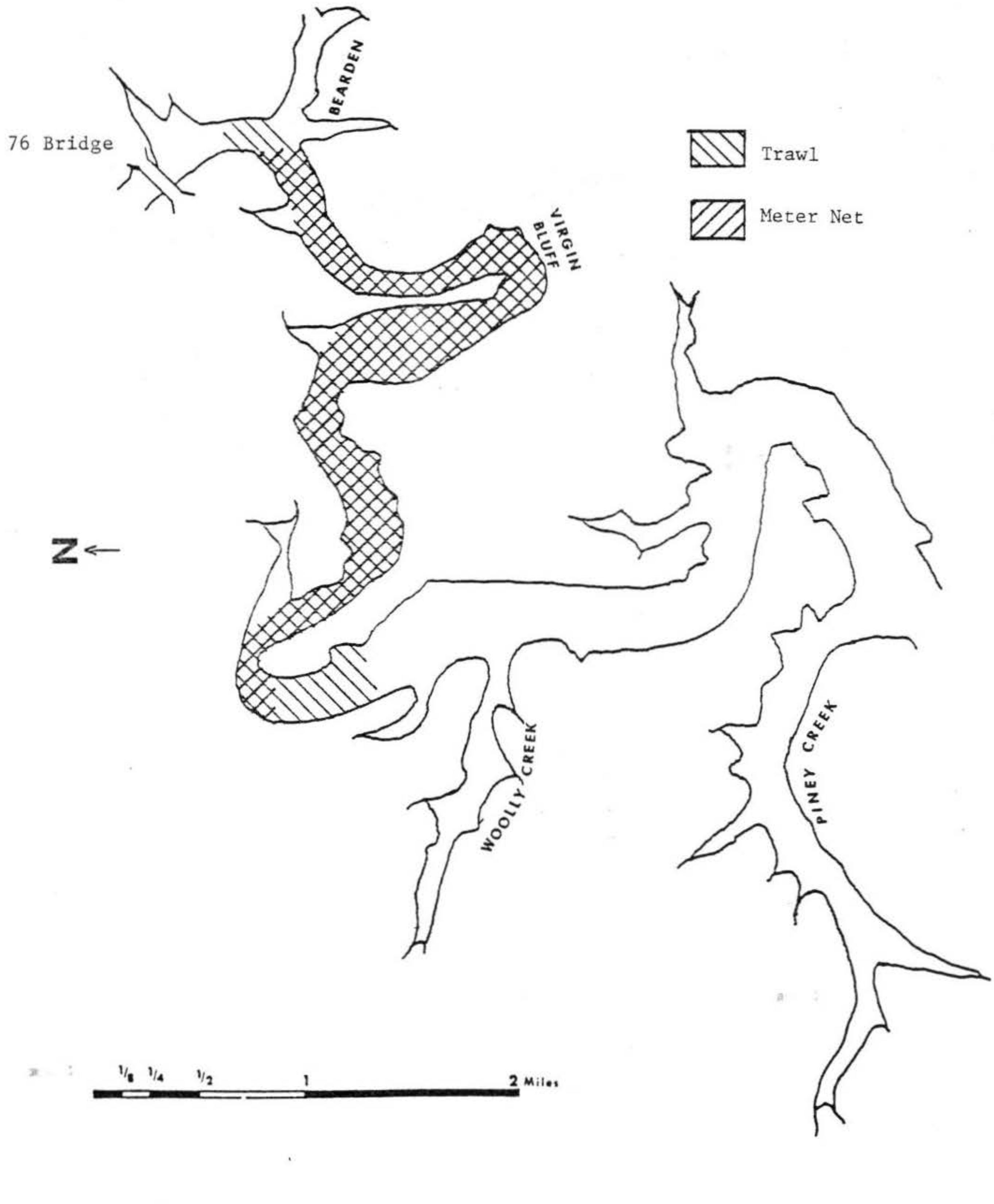


Figure 6. Standard meter net and mid-water trawl areas that were sampled on the Long Creek Arm of Table Rock Lake. Letter "A" indicates the standard April-May meter net area adjacent to the spawning cove while the June samples included the rest of the meter-net area.

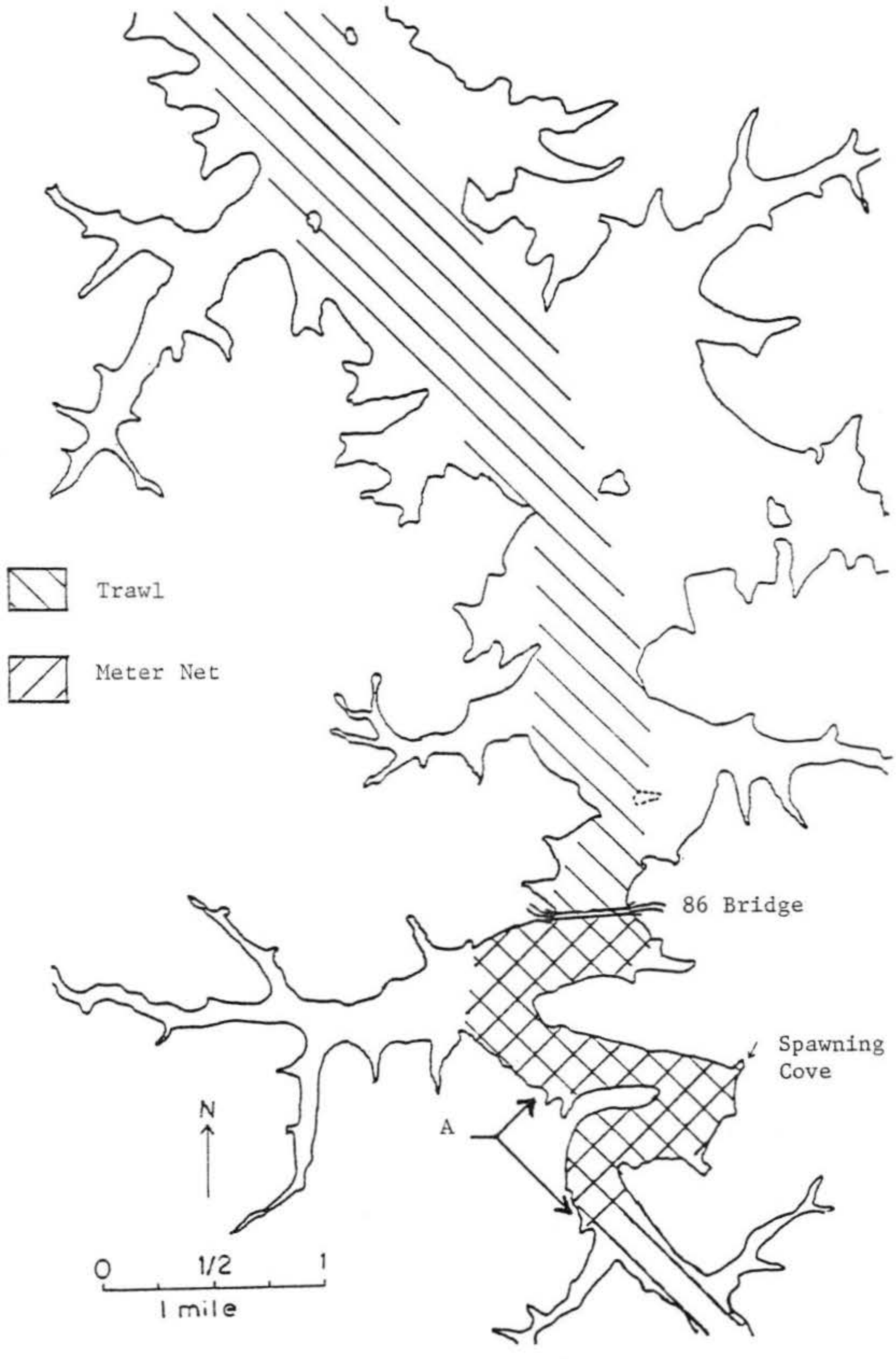
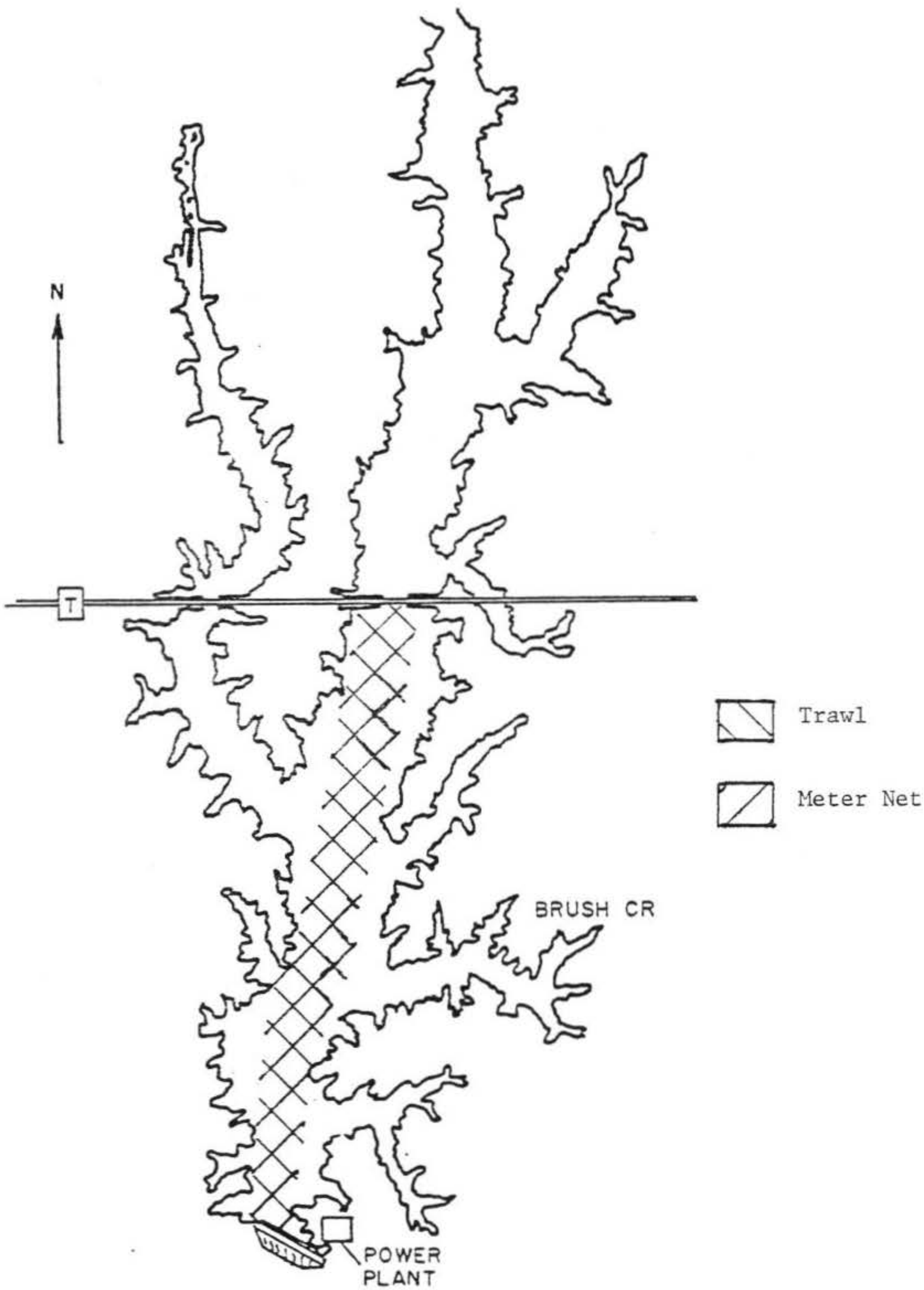


Figure 7. Standard meter net and mid-water trawl areas that were sampled on Thomas Hill Lake.



PART 1: YEAR-CLASS VARIABILITY, AGE-0 SAMPLING, AND PREDICTING YEAR-CLASS STRENGTH

METHODS

Determining Year-Class Strength

Year-class strengths of white crappie were computed from harvests estimated from roving creel surveys (Lambou 1961; Hanson 1977; and Dent 1986) on four of the reservoirs, and from probability surveys on Wappapello Lake (Fleener 1971). Creel clerks measured white crappie to the nearest 2.5 mm to obtain the length frequencies of harvested fish. These length frequencies were compared to the length frequencies and the corresponding age structures of white crappie captured in standard fall trap-net samples (Colvin and Vasey 1986). The number of white crappie harvested from each age group was then estimated, after corrections were made for seasonal and yearly growth.

Each year class of crappie in a reservoir was given a relative year-class-strength rating of 1 (small), 2 (medium), or 3 (large) based upon standard criteria for that reservoir. These criteria were developed by summing the estimated harvests of each year-class as age-I through age-IV fish and then subjectively dividing them into three groups (Table 2). Criteria varied among the reservoirs because of differences in their basic productivity and number per acre harvested.

Sampling Age-0 Crappie

Age-0 crappie were sampled by meter netting, mid-water trawling, and trap netting.

A meter net (Netsch et. al. 1971) 1 m in diameter with 0.8 by 0.6 mm mesh netting was used to capture larval crappie. The net was towed at 1.8 m/sec for approximately 4 min at a depth of 4.6 m through the center sections of the study areas at night. This time

Table 2. Criteria used to rate white crappie year-class strength from small to large on 5 Missouri reservoirs. The statistic used was the estimated harvest of a year class from Age I through IV.

	Number Harvested Per Acre		
Reservoir[a]	Small = 1	Medium = 2	Large = 3
NIA	<15	15-29	≥30
PDT	<15	15-29	≥30
SAC	< 6	6-14	≥15
JRA	< 6	6-14	≥15
WAP	<10	10-19	≥20

[a] Abbreviations for reservoirs are given in Appendix A.

of day and depth consistently produced the highest catches of crappie larvae. A typical tow filtered 304 m^3 of water (SD = 7.6) and 12 tows were usually made each night. Samples were preserved in 10% formalin. In the laboratory, larval fish were removed and identified where all crappie were measured to the nearest 2 mm, and other species were grouped into larger length categories. Results of all tows taken on one night were combined because consistent differences in capture rates of crappie larvae between individual tow sites could not be detected on any of the reservoirs.

Sampling procedures were developed on the two study arms of Table Rock Lake (Table 1, Figures 5 and 6), where larvae were sampled at least once each week from late April or early May through early June in an attempt to identify mortality patterns. This time frame was chosen because it encompassed most of the crappie spawning period as observed by scuba diving during a nine-year period in the Long Creek Arm of Table Rock Lake. From 1969-1977 the mean starting and stopping dates for crappie spawning were April 14 and June 6 (F.Vasey, personal communication). Beginning in 1973, other reservoirs were sampled in early June (Appendix B) in an attempt to develop an index of year-class strength based upon post-spawning capture rates of larval crappie. Some of these reservoirs were also sampled in May to better monitor larval crappie abundance and identify mortality patterns throughout the spawning period.

From 1972-1975, crappie larvae were sampled in a small, 1.2-ha cove adjacent to the main lake study area on the Long Creek Arm of Table Rock Lake in order to compare sizes and relative abundance of larvae between a known spawning cove (Vasey 1969) and adjacent main lake pelagic areas. Two tows were usually taken in the cove on the same nights that the main lake sites were sampled during April and May. Tows were made in the center of the cove for approximately 1 min each and an estimated 76 m^3 of water were filtered per tow.

The capture rates of age-0 crappie taken each night in the spawning cove and main lake pelagic sites were compared with a Wilcoxon sign rank test (SAS Institute Inc. 1985) to determine if there was a significant difference in densities of larvae. In addition, the length frequencies of larvae captured in the two areas were compared using the chi-square test of independence or likelihood ratio for small cell size (SAS Institute Inc. 1985) to determine if there was a difference in the size distributions of larvae. A significant difference may indicate larval movement or change in habitat preference during growth. Of the 36 comparisons between cove and pelagic areas, 22 were tested with the chi-square tests. The significance level for all statistical tests was set at 0.05.

A mid-water trawl, 2.4 m square at the mouth, 11 m long, and constructed with 25, 13, 10, and 5 mm stretch mesh nylon netting was used to sample post-larval and juvenile crappie. From 6 to 12 hauls were made after dark in the same general areas as were the meter net tows (Figures 2-7). Hauls were 10 min long at approximately 2 m/sec, and filtered an estimated 7,135 m^3 of water. Samples were preserved in 10% formalin and identified in the laboratory, except that large catches of age-0 shad were measured volumetrically and a subsample was preserved. Because crappie catches were typically low, results of all hauls taken each night were combined. Trawling was conducted from June through September during 1972 through 1977 on the two study arms of Table Rock Lake. Other reservoirs were typically sampled in September (Appendix C).

Trap nets were used to sample age-0 crappie in October (Colvin and Vasey 1986) nearly every year from 1973-1986 on the Niangua Arm of Lake of the Ozarks, Pomme de Terre Lake, the Sac Arm of Stockton Lake, the James River Arm of Table Rock Lake, and Wappapello Lake.

Predicting Year-Class Strength from Catches of Age-0 Crappie

Spearman rank correlation coefficients (SAS Institute Inc. 1985) were used to determine if catches of age-0 crappie from the various sampling methods were significantly related to the year-class-strength ratings. Early in the course of the study it appeared that not only the number but also the size of age-0 crappie captured with the meter net might be indicators of early survival and year-class strength. The presence of larvae 12 mm and longer by the first of June on the James River Arm of Table Rock Lake appeared to be associated with large year classes. It therefore seemed logical that the number of larger larvae (18 mm and longer) might be an even better indicator of a large year-class. Therefore, correlation coefficients were calculated between the year-class-strength rating and the following parameters of age-0 capture rates: total, total greater than 12 and 18 mm, and percent greater than 12 and 18 mm, all from the meter net samples taken in June; total captured with the mid-water trawl in September; and number captured per trap-net day in October. When more than one June sample was taken, the correlation calculated from the earliest date is the one presented in this report.

For significant Spearman rank correlations ($p \leq 0.05$), the simple linear correlation and regression relationships between the capture rate parameters and the estimated year-class size (number harvested) of crappie were calculated to determine if predictive models could be developed. Using this procedure first, instead of comparing capture rates directly with the estimated year-class size, was necessary because extremely large harvests or age-0 capture rates can cause relationships to appear highly significant when most of the observations indicate that they are not.

Capture rates of age-0 crappie from the various sampling methods were also compared with each other by simple linear correlation to determine if catches with one method were related to another.

RESULTS

Year-Class Variations

White crappie year-class strength was highly variable (Table 3). Year-class strength was the most consistent on Wappapello Lake and the Niangua Arm of Lake of the Ozarks followed by Pomme de Terre Lake, the Sac Arm of Stockton Lake, and the James River Arm of Table Rock Lake. Annual fluctuations in year-class strength were not synchronous among the reservoirs (i.e. not all reservoirs had large or small year classes produced in the same year, except in 1973), nor were they predictable within a reservoir (Figure 8).

Age-0 Crappie Sampling

Larval shad (Dorosoma spp), crappie, white bass (Morone chrysops), sunfish (Lepomis spp), and freshwater drum (Aplodinotus grunniens) were the fishes most frequently captured with the meter net in all of the study reservoirs (Appendices B and D). Capture rates of all larval fishes varied by several orders of magnitude among reservoirs and from year to year. Larval crappie were first captured during the last week of April or first week of May in most years on the two study arms of Table Rock Lake (Appendix B).

On the Long Creek Arm of Table Rock Lake, capture rates were significantly higher ($p < 0.01$) in the spawning cove than in the adjacent pelagic areas on 32 of the 36 days sampled (Appendix E). The difference in densities did not appear to change as sampling progressed through the spring. Chi-square tests on length frequencies indicated that the percentages of larvae in the different size groups were significantly different between the two habitat types on 16 of the 22 days tested (Appendix E). In all but one of these samples (5/9/73), 4 to 6 mm larvae were proportionally more abundant in the cove than in the pelagic areas.

Table 3. Number of white crappie harvested per acre from each year class and the relative year-class-strength ratings for 5 Missouri reservoirs.

	Reservoirs									
	NIA		PDT		SAC		JRA		WAP	
Year Class	Harvest	Rating	Harvest	Rating	Harvest	Rating	Harvest	Rating	Harvest	Rating
1973	---	3[a]	---	3[a]	---	3[a]	21.8	3	---	---
1974	20.8[b]	2[a]	---	1[a]	---	2[a]	1.0	1	---	---
1975	17.3	2	13.0	1	---	3[a]	1.0	1	---	---
1976	24.0	2	13.2	1	37.7	3	1.0	1	---	3[a]
1977	10.9	1	46.2	3	10.9	2	23.5	3	17.5[f]	2
1978	25.2	2	13.6	1	23.7	3	8.0	2	16.5[f]	2
1979	30.2	3	41.9	3	3.0	1	21.4	3	16.8[f]	2
1980	9.1	1	8.1	1	15.7	3	2.2	1	8.9	1
1981	37.0	3	23.3	2	5.1	1	1.0	1	24.8	3
1982	22.1	2	24.0[d]	2	6.5[c]	2	9.1	2	39.5	3
1983	---	1[a]	12.5[d]	1	7.6[c]	2	---	1[a]	27.1	3
1984	---	---	---	1[a]	---	2[a]	---	2[a]	---	---
Mean (S.D.)[e]	22.0 (9.4)		21.8 (13.7)		13.8 (11.7)		9.0 (9.6)		21.6 (9.9)	
Range	9.1 - 37.0		8.1 - 46.2		3.0 - 37.7		1.0 - 23.5		8.9 - 39.5	
Coefficient of Variation (V)	43%		63%		85%		107%		46%	

Table 3. (cont.)

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[a] Harvest estimates for ages I-IV were not complete so the year-class-strength rating was estimated from the available years of data.

[b] Estimated harvest of age II-IV; age I harvest not available.

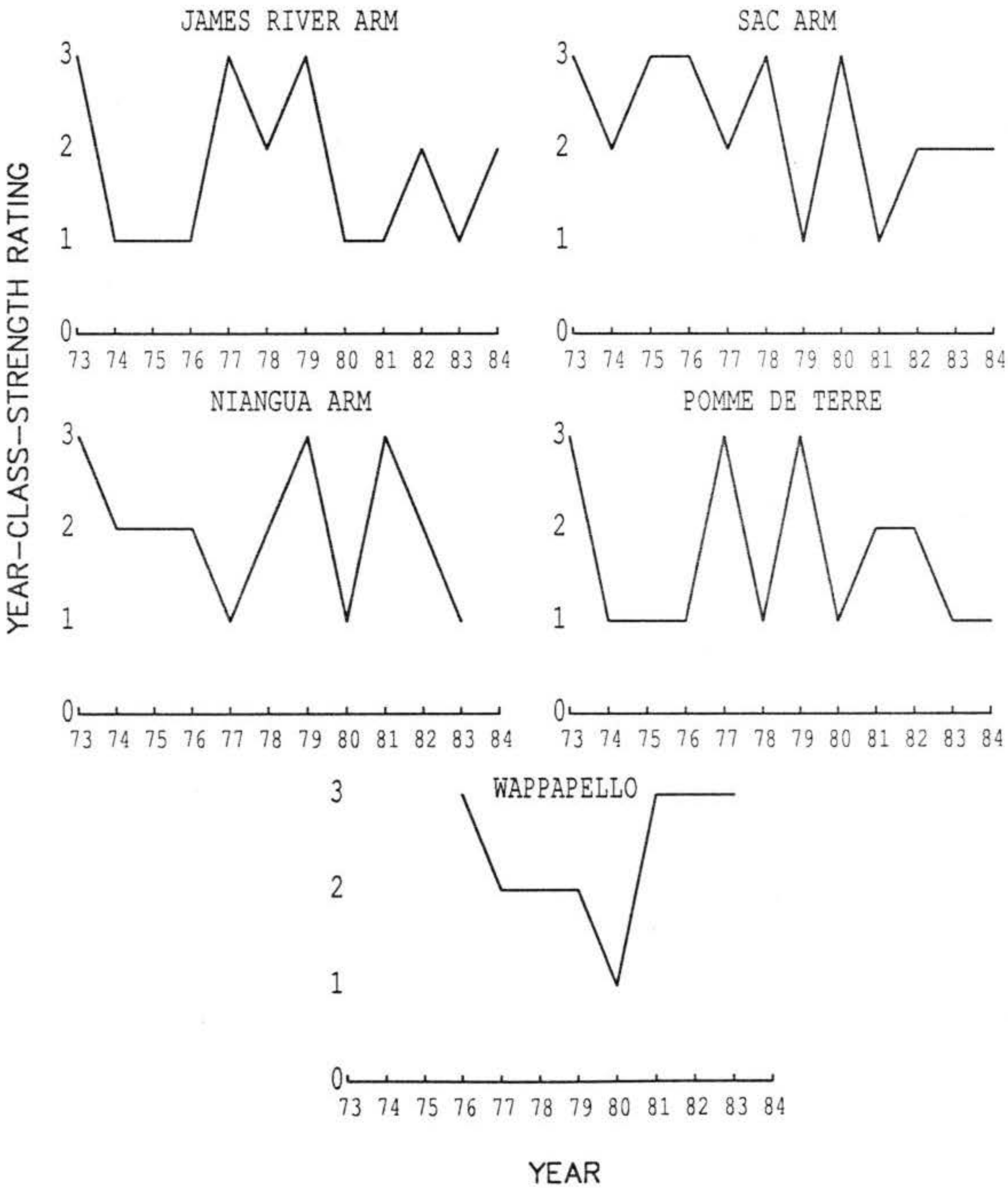
[c] Actual harvest expanded to approximate what it would have been without the 10-inch minimum size limit and 15-daily limit that was implemented in 1984.

[d] Actual harvest expanded to approximate what it would have been without the 15-daily limit that was implemented in 1984.

[e] Includes only the years where age-I harvest was calculated in the total.

[f] Actual harvest expanded to approximate what it would have been without the 10-daily limit that was in effect from 1978-1980.

Figure 8. Variations in the relative year-class-strength ratings of white crappie on five Missouri reservoirs.



Mortality patterns of crappie larvae captured with the meter net differed from year to year (Appendix B). Survival appeared to be very good in some years as progressively larger larvae were captured throughout the spring and densities remained high. This pattern was especially evident on the Niangua Arm of Lake of the Ozarks in 1979 and the Long Creek Arm of Table Rock Lake in 1973. Conversely, survival appeared to be extremely low in 1972, 1974, 1975, and 1976 on the James River Arm of Table Rock Lake when few larvae of any size were captured. In most other years apparent survival was intermediate to these two extremes and in some years was initially high and declined thereafter (e.g. the James River Arm in 1977 and 1982) or initially low and increased thereafter (e.g. the James River Arm in 1979).

Capture rates of age-0 crappie from the June meter netting on the 5 reservoirs where year-class strength was rated ranged from a low of 0 per 1,000 m^3 in 1974 and 1975 on James River Arm of Table Rock Lake to over 4,000 in 1979 on Pomme de Terre Lake (Table 4). Capture rates of crappie larvae longer than 12 and 18 mm and the percentages of total larvae over those sizes were also highly variable (Appendix F).

Most of the mid-water trawl catches were composed of age-0 gizzard shad (Appendix C). Capture rates of threadfin shad were also high in reservoirs where they were present. Many other species were captured with the trawl, but capture rates were highly variable. Age-0 crappie were captured on 33 of the 101 sampling days and their capture rates ranged from 0 fish per 10,000 m^3 on several reservoirs to 240 in 1974 at Thomas Hill Lake, but were usually less than 10 (Appendix C). Capture rates from the September samples on the 5 reservoirs where year-class strength was rated were also variable (Table 4).

Mortality patterns of age-0 crappie when mid-water trawling was conducted throughout the summer to early fall period on the two study arms of Table Rock Lake could not be determined in 9 of the 10 periods sampled. No age-0 crappie were captured

Table 4. Capture rates of age-0 crappie with meter nets, mid-water trawls, and trap nets from five Missouri reservoirs. Abbreviations for reservoirs are given in Appendix A and for sampling gears are given in the footnotes. M indicates no sample was taken.

	Reservoirs														
	NIA			PDT			SAC			JRA			WAP		
Year	MN	MWT	TN	MN	MWT	TN	MN	MWT	TN	MN	MWT	TN	MN	MWT	TN
1973	79	7.0	3.6	140	2.0	M	73	1.0	M	10	0.7	2.7	M	M	M
1974	289	0.8	1.6	422	0.0	0.2	110	0.0	M	0	0.0	0.0	M	M	M
1975	431	0.0	2.1	219	0.0	0.1	156	0.0	0.1	0	M	0.1	M	M	M
1976	163	0.6	4.4	696	0.0	0.3	306	0.3	0.8	5	0.0	tr[1]	M	M	14.8
1977	86	0.2	0.6	M	2.0	2.2	77	0.8	0.4	13	0.2	14.2	399	M	7.8
1978	141	0.5	2.8	789	0.0	0.0	2,102	0.0	0.7	19	0.2	0.1	276	M	0.4
1979	1,605	M	6.4	4,216	M	2.1	849	M	0.1	102	M	0.8	3,239	M	4.3
1980	66	M	0.3	134	M	0.1	1,085	M	0.9	263	M	0.9	70	M	2.7
1981	777	2.0	4.9	56	M	1.3	206	M	0.9	169	M	tr[1]	223	M	5.6
1982	549	M	1.1	1,622	M	0.3	117	M	0.2	404	M	0.1	M	M	5.9
1983	235	M	0.1	553	M	0.1	58	M	2.6	177	M	M	M	M	15.0
1984	234	M	1.1	415	M	0.8	242	M	0.0	640	M	M	M	M	M
1985	264	M	0.5	43	M	0.7	293	M	0.2	130	M	M	M	M	M
1986	190	M	2.5	126	M	M	130	M	0.5	2	M	M	M	M	M

[1] tr = less than 0.1 per trap-net day

Gear abbreviations are: MN = number captured per 1,000 m^3 with the meter net in June; MWT = number captured per 10,000 m^3 with the mid-water trawl in September; TN = number captured per trap-net day in October.

during 7 of the periods (Appendix C) and capture rates were low and variable in 2 (1977 on the James River Arm and 1973 on Long Creek). Age-0 crappie were captured on all dates sampled in 1973 on the James River Arm when they declined from a high of 27 per 10,000 m^3 in June to less than 1 per 10,000 m^3 in September.

Mean capture rates of age-0 crappie ranged from 0 to 15 per trap-net day on the 5 reservoirs where year-class strength was rated (Table 4).

Relationships Between Age-0 Capture Rates and Year-Class Strength

The capture rate parameters of crappie larvae from June meter-netting were generally not significantly related to year-class strength. Spearman rank correlation coefficients indicated that only the capture rate and the percentage of larvae 12 mm and longer on the James River Arm of Table Rock Lake were significantly related to the year-class-strength rating (Table 5). Spearman rank correlation coefficients for the total number of larvae captured or for the number or percentage 18 mm and longer were not significant on any of the 5 reservoirs tested. However, high capture rates of at least 1,000 larvae per 1,000 m^3 sampled were always associated with medium or large, but never with small year classes. The opposite did not hold true for small catches of larvae: capture rates from 10 to 50 per 1,000 m^3 were associated with all three year-class-strength ratings. However, small year classes were observed on the James River Arm of Table Rock Lake in 1974 and 1975, the only two years when no larvae were captured in June (Tables 3 and 4).

Spearman rank correlation coefficients indicated that capture rates of age-0 crappie with the mid-water trawl and trap nets were generally better predictors of year-class strength than were meter-net catches. Significant correlations between both methods and the year-class-strength rating were found for the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake, and trap-net catches were also significantly related on the James River Arm of Table Rock Lake (Table 5). Capture rates with the trawl and trap nets were

Table 5. Spearman rank correlation coefficients for the relationships between the relative year-class-strength ratings of white crappie and catches of age-0 crappie with either the meter net, mid-water trawl or trap nets on 5 Missouri reservoirs. (Numbers in parentheses are the sample sizes in years. An asterisk indicates a significant correlation at the 0.05 level. See Appendix A for definition of abbreviations.)

	Meter Net						
Reservoir	MNTOT	TOT12	PER12	TOT18	PER18	Trawl	Trap
NIA	0.51 (11)	0.47 (11)	0.19 (11)	0.45 (11)	0.37 (11)	0.85* (7)	0.90* (11)
PDT	0.09 (11)	0.16 (11)	0.42 (11)	0.27 (11)	0.16 (11)	1.00* (6)	0.80* (11)
SAC	0.18 (12)	0.24 (12)	0.38 (12)	0.24 (12)	0.24 (12)	0.00 (6)	0.10 (10)
JRA	0.12 (12)	0.65* (12)	0.78* (12)	0.43 (12)	0.43 (12)	0.88 (5)	0.75* (10)
WAP	0.22 (5)	0.22 (5)	-0.22 (5)	-0.22 (5)	-0.22 (5)	---	0.68 (8)

very poorly related to the year-class-strength rating on the Sac Arm of Stockton Lake while the relationship was better, but not significant, for trap nets on Wappapello Lake.

Most of the age-0 capture rate parameters that were significantly related to the year-class-strength rating were also significantly correlated to the estimated number of fish harvested from that year class (Table 6). The capture rate of age-0 crappie with the mid-water trawl was a good predictor of year-class size on the Niangua Arm of Lake of the Ozarks and was best described by the relationship: $Y = 15.0 + 11.0(X)$, where Y is the estimated harvest of a year class from age I-IV and X is the number of age-0 crappie captured per 10,000 m^3 with the mid-water trawl in September (Figure 9). The correlation between trawl catches and year-class size on Pomme de Terre Lake was also highly significant, but the relationship is a result of only 4 data points; 2 for small, and 2 for large year classes (see Appendix F).

The capture rate of age-0 crappie in trap nets was also a good predictor of estimated harvest on the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake (Table 6 and Figure 10). The relationships were: $Y = 12.4 + 3.5(X)$ for the Niangua Arm, and $Y = 11.3 + 14.4(X)$ for Pomme de Terre, where Y is the estimated harvest of a year class from age I-IV and X is the number of age-0 white crappie captured per trap-net day. The relationship was also significant on the James River Arm of Table Rock Lake, but the r^2 value was only 41% (Figure 10).

Capture rate parameters from the various sampling methods were generally not significantly correlated to one another (Table 7). None of the correlations were significant on the Sac Arm of Stockton Lake, while those that were significant on the other reservoirs were the result of extreme values from a single year's sampling. Years that strongly influenced the correlations were 1977 on the James River Arm of Table Rock Lake and 1979 on the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake.

Table 6. Simple linear correlation coefficients for the relationships between age-0 crappie catches and the estimated harvest of that year class on 3 Missouri reservoirs. (Parameters used were the significant ones from Table 4. Number in parenthesis is sample size in years and an asterisk indicates a significant relationship at the .05 level. Note that sample sizes do not correspond to the Spearman correlations because all year classes that were rated could not be quantified as number per acre. See Appendix A for definition of abbreviations.)

Reservoir	Parameter	Correlation Coefficient
NIA	TRAWL	0.89* (6)
	TRAP	0.84* (9)
PDT	TRAWL	1.00* (4)
	TRAP	0.95* (9)
JRA	TOT12	0.13 (10)
	PER12	0.56 (10)
	TRAP	0.64* (10)

Figure 9. Relationship between the capture rate of age-0 crappie (number per 10,000 cubic meters) from standard September mid-water trawl hauls and the number of white crappie harvested from that year class on the Niangua Arm of Lake of the Ozarks.

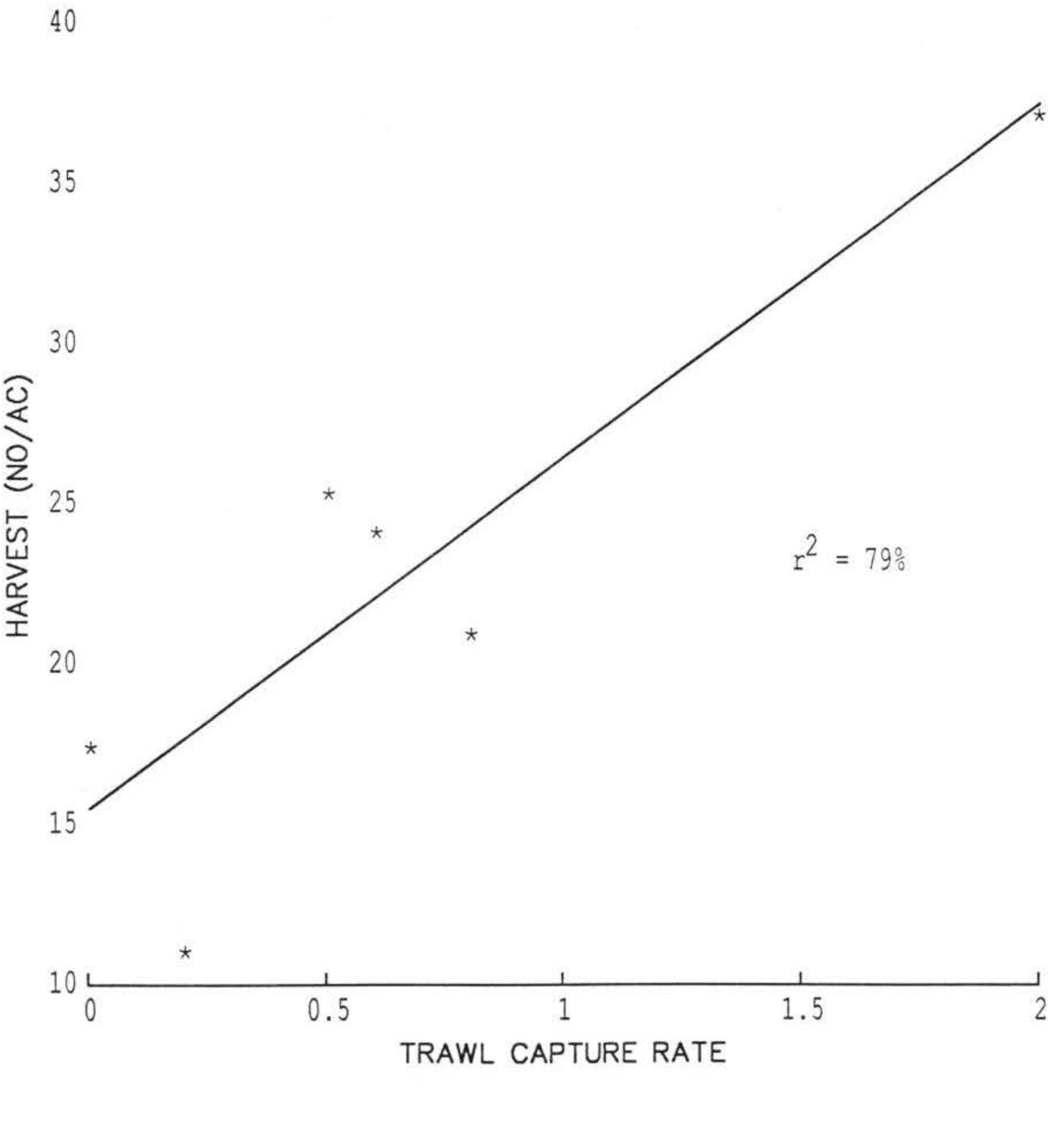


Figure 10. Relationships between the number of age-0 white crappie captured per trap-net day in October and the estimated harvest from that year class on three Missouri reservoirs.

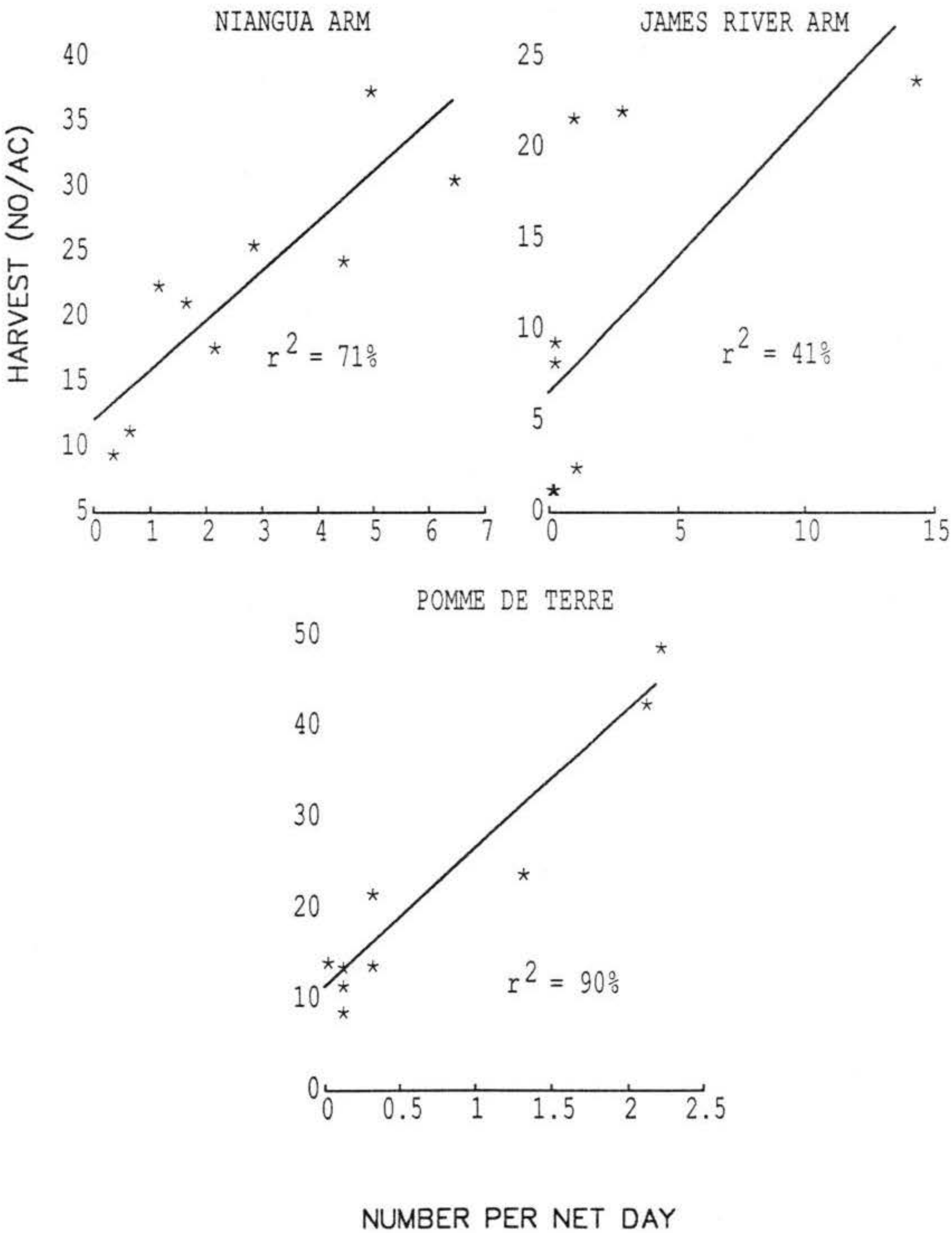


Table 7. Simple linear correlation coefficients for the relationships between age-0 crappie capture rate parameters with the meter net, mid-water trawl, and trap nets on four Missouri reservoirs. (An asterisk indicates a significant correlation where $p \leq 0.05$. See Appendix A for definition of abbreviations.)

		Parameters					
Reservoir		MNTOT	TOT12	PER12	TOT18	PER18	TRAWL
NIA	TRAWL	-0.16	-0.44	-0.49	-0.27	-0.29	
	TRAP	0.66*	0.62*	0.27	0.60*	0.43	0.38
PDT	TRAWL	-0.61	-0.32	0.01	-0.29	-0.25	
	TRAP	0.66*	0.77*	0.56	0.80*	0.60*	0.99*
SAC	TRAWL	-0.42	-0.41	-0.72	-0.39	-0.56	
	TRAP	-0.03	0.01	-0.29	0.08	-0.05	0.03
JRA	TRAWL	0.37	0.03	0.01	-0.04	-0.04	
	TRAP	-0.23	0.08	0.98*	0.98*	0.98*	0.14

DISCUSSION

White crappie year-class strength was highly variable. Predictable patterns in year-class strength were not discernible for any of the 5 reservoirs examined, and no two reservoirs showed the same changes from year to year, so future year-class strength could not be predicted based upon previous observations. Large year classes did not occur in consecutive years except at Wappapello Lake (and once on the Sac Arm of Stockton Lake, Figure 8), suggesting that the conditions needed to produce them occur infrequently.

Crappie spawned every year in the study cove on the Long Creek Arm of Table Rock Lake (F. Vasey pers. comm.), so the initial abundance of larvae should have been higher there than in the main lake. However, we thought it reasonable to expect that, as spawning progressed and more larvae dispersed from the nest, an increasing percentage of both the total larvae and larger larvae would be found in main lake pelagic areas. In this study, the percentage of 4-6 mm larvae was consistently higher in the study cove--which supports our scenario--but the percentage of larger larvae was not consistently higher in the main lake areas. Also, the total density of larvae remained higher in the cove throughout the spring period, and this difference did not appear to change noticeably over time (Appendix E). Unfortunately, the change in capture rates between cove and pelagic areas over time could not be tested statistically because of the small sample size and high variability of the data. It is difficult to determine if the higher densities in the study cove were due to habitat preference by crappie larvae, or simply to the effect of greater dilution of larvae as they dispersed into the pelagic areas. Crappie larvae have been found to be more abundant in coves in some years on other waters, too, e.g. Lake Shelbyville, Illinois (Storck et. al. 1982), but if the relationship between the two habitats is to be studied further in Missouri, more and larger coves should be sampled in along with main lake stations.

If meter net capture rates truly represented relative densities and size structures of crappie larvae, then annual mortality patterns were variable. I assumed that by early June (which was near the end of the spawning period), the initial mortality period would be over and that the remaining larvae would be good indicators of year-class strength. Even though extremely high capture rates of larvae indicated medium or large year classes and the absence of larvae indicated small, it was not possible to predict year-class strength because 90% of the samples were between these two extremes. Furthermore, some large year classes were produced when few larvae were captured in June.

Mid-water trawl sampling was discontinued on a regular basis after 1978 because capture rates of age-0 crappie were extremely low (Table 4). Even though there were significant relationships between trawl catches and year-class strength for the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake, they were based on capture rates of 2 or fewer age-0 crappie per 10,000 m^3 of water sampled. Further improvements on the trawl method might be made by using oblique tows and by sampling cove as well as pelagic habitats.

Trap-net capture rates of age-0 crappie were significantly related to year-class strength on more reservoirs than any other variable and yielded relatively accurate predictions of white crappie harvest on the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake (Figure 10). Even though the relationship was not significant for Wappapello Lake, high capture rates always indicated a large year class. It therefore appears that year-class strength is determined by October. Consequently, the capture rate of age-0 crappie in October trap-net samples has been used as an index of recruitment and incorporated into an assessment of the quality of white crappie populations in Missouri's large reservoirs (Colvin and Vasey 1986). An exception to this was the Sac Arm of Stockton Lake where year-class strength could not be predicted from trap-net samples. Capture rates were less than one fish per net day in all but one of the years

sampled (Table 4) indicating that even large year classes were not sampled as effectively as in the other reservoirs.

Relationships between capture rates of age-0 crappie and year-class strength could be affected by factors that would change the estimated harvest of that year class, such as abnormal water levels that would reduce fishing success or high natural mortality resulting from major epizootics. Such incidents might result in high capture rates of age-0 crappie associated with small year-class-strength ratings. However, these factors do not appear to have been major problems in this study because poor correlations were the result of low capture rates associated with medium and large year-classes.

Periods of high mortality that could determine year-class strength of white crappie may occur any time during their first year of life. In some years mortality is high for larvae immediately after they leave the nest and remains high for several weeks, resulting in a small year class. In other years mortality patterns may change during the year (e.g. high early and low later versus low early and high later) resulting in medium or large year classes. Determining the factors that affect survival is therefore extremely difficult since the patterns and timing of mortality may change annually. Because of this variability, the concept of "critical periods" as discussed by Blaxter (1969) and Hokanson (1977) does not appear to directly apply to crappie in Missouri's large reservoirs.

In this study it might have been helpful to have sampled some other reservoirs more intensively with the meter net. Unfortunately, year-class strength could not be accurately rated on the Long Creek Arm of Table Rock Lake, and the mortality patterns of larvae on the James River Arm were unlike those of the other reservoirs (it was the only one where no larvae were captured in some years). More intensive sampling on Pomme de Terre and Lake of the Ozarks might have provided more insight into mortality patterns of larval crappie.

PART II: EVALUATION OF FACTORS THAT MAY INFLUENCE YEAR-CLASS STRENGTH

Yearly variations in reservoir inflows and associated changes in water levels and releases are considered important factors influencing recruitment of reservoir fishes (Ploskey 1986). High inflows and water levels have been associated with increased recruitment, but the mechanisms controlling these increases are poorly understood. Rising water levels may provide escape cover for age-0 fish by flooding terrestrial vegetation or by increasing food production from the decomposition of the vegetation. High inflows also increase reservoir nutrient levels from allochthonous organic material, which can increase production of zooplankton that are important food for larval fishes. The timing, magnitude, and duration of high inflow and water levels may be important factors that determine the level of recruitment (Ploskey 1986). Conversely, receding water levels or high discharge rates during spring may negatively affect recruitment. Suspected causes are stranding of eggs or larvae, disrupting of normal spawning behavior, or flushing of larval fish from the reservoir (Beam 1983).

The relationship between crappie density and recruitment as postulated by Bennett (1944) and Swingle and Swingle (1967) might be twofold. First, density of immature crappies would be negatively correlated to recruitment probably because of competition for food or predation on age-0 fish. Second, density of adult crappie would be positively related to recruitment because of the increased potential for producing young fish. The result of these interactions would be predictable three- to five-year "cycles" of strong year classes. Even though the occurrence of strong year classes was not predictable on Missouri reservoirs, they seldom occurred in consecutive years, which might be evidence of a relationship between stock and recruitment.

The objective of this portion of the study was to determine if significant relationships existed between several reservoir water level and flow parameters, crappie stocks, and white crappie year-class strength.

METHODS

Hydrologic Parameters

Reservoir Water Levels and Flow records were obtained from U.S. Army Corps of Engineers District offices for Pomme de Terre Lake, Stockton Lake, and Table Rock Lake, and from Union Electric Company for Lake of the Ozarks. Because yearly mortality patterns of age-0 crappie vary, several inflow, outflow, and water level parameters were calculated to cover much of a cohort's first year of life. Total inflow in acre-feet was calculated for three periods: 1) September through May, to cover major events prior to and during spawning, 2) April through May, to cover most of the crappie spawning period, and 3) April through September, to cover events during spawning through most of the first growing season. Except for a few years on the Long Creek Arm of Table Rock Lake, the exact time and peak of spawning was not determined for reservoirs in this study. Therefore, the effect of changes in water levels during spawning could not be determined. Instead, reservoir releases or outflows in acre-feet during May and June (the period of peak larval abundance) were calculated to determine if larvae might have been flushed from the reservoirs during their first few weeks of life.

If decomposition of terrestrial vegetation is to affect crappie year-class strength, the vegetation must first have time to grow, and then be inundated long enough to decompose and release nutrients into the water. Therefore, water levels in late summer or early fall prior to spawning may be important starting points since there would still be time for growth of vegetation before typical fall or early spring inflows cause levels to rise. Based on these assumptions, the magnitude and duration of changes in water levels were calculated from September prior to spawning through the following May, which includes most of the

spawning period, and from September through August, which also includes much of the first growing season for age-0 crappie. Each month of the year was considered to be 30 days long, and the changes in water levels were calculated as elevation days by subtracting the elevation on the 15th and last day of each month from the September 1 level, and multiplying the differences by the elapsed time (15 days). These values were summed over the entire time period and expressed as elevation days above or below the September 1 level.

Spearman rank correlation coefficients were used to compare the reservoir hydrologic parameters to the white crappie year-class-strength ratings. If a correlation was significant, the parameter was then compared by linear regression to the estimated harvest of that year class to determine if a predictive model could be developed. In addition, the September-May inflows, April-May inflows, and elevation days from September-May were compared by simple linear correlation to the June meter-net capture rates of crappie larvae to determine if these parameters were related to early survival or production.

Stock-Recruitment Relationships

Crappie stock-recruitment relationships were determined for the Niangua Arm of Lake of the Ozarks, Pomme de Terre Lake, the Sac Arm of Stockton Lake, the James River Arm of Table Rock Lake, and Wappapello Lake. Spearman rank correlation coefficients were calculated to determine if significant relationships existed between a year-class's relative size rating and the estimated density of yearling, immature (age I and II), mature (age III and IV), and all white crappie. (Densities of crappie older than age IV were not included because they constituted a very small portion of the crappie population and were not consistently sampled with trap nets). Crappie stock densities for a given year were calculated by summing the appropriate year classes' harvests on that year with their harvests each year through age IV. For example, the estimated number of yearlings present in 1976 would be the sum of the estimated harvests of the 1975 year class from

age I through IV; and the number of immature crappie present (age I and II's) would be the number of yearlings present in 1976 plus the estimated harvests of the 1974 year class from age II through IV. For correlations that were significant, linear regression models were calculated to determine if year-class size could be predicted from the various stock parameters.

RESULTS

All of the reservoir inflow, outflow, and elevation parameters were highly variable among the reservoirs (Appendix F). Inflows were high in all of the reservoirs from April-September in 1973, while they were generally the lowest in 1980. Fluctuations in water levels expressed as elevation days were highest on the Sac Arm of Stockton Lake and the James River Arm of Table Rock Lake; the Niangua Arm of Lake of the Ozarks and Pomme de Terre Lake had lesser annual changes.

None of the reservoir water parameters were significantly related to either year-class-strength ratings or capture rates of crappie larvae with the meter net in June (Tables 8 and 9).

Based on the estimated harvests of the various age groups, it was not uncommon for total white crappie stocks to exceed 50 fish per acre (Appendix F). Total stocks varied the greatest on the Sac Arm of Stockton Lake and the James River Arm of Table Rock Lake, and least on the Niangua Arm of Lake of the Ozarks and Wappapello Lake.

Most of the stock parameters were not significantly related to the year-class-strength ratings. The only exceptions were density of immature and total density of crappie, which were inversely related to the ratings on the Niangua Arm of Lake of the Ozarks (Table 10). These two parameters also explained more than 60% of the variation in estimated year-class size (Figure 11), which was best estimated by the following formulas:

Table 8. Spearman rank correlation coefficients for the relationships of reservoir inflow, outflow, and elevation change parameters to the year-class-strength ratings of white crappie on 4 Missouri reservoirs. (Sample sizes in years are in parenthesis).

	Inflow			Outflow	Elevation Days	
Reservoir	Sept-May	April-May	April-Sept	May-June	Sept-May	Sept-August
NIA	0.05 (10)	0.16 (11)	0.51 (11)	0.39 (11)	0.39 (10)	0.29 (10)
PDT	-0.22 (12)	0.12 (12)	0.43 (12)	0.30 (12)	-0.11 (12)	0.18 (12)
SAC	0.23 (12)	0.20 (12)	-0.35 (12)	-0.09 (12)	0.54 (12)	0.18 (12)
JRA	0.07 (12)	0.31 (12)	0.24 (12)	0.19 (8)	0.14 (12)	0.14 (12)

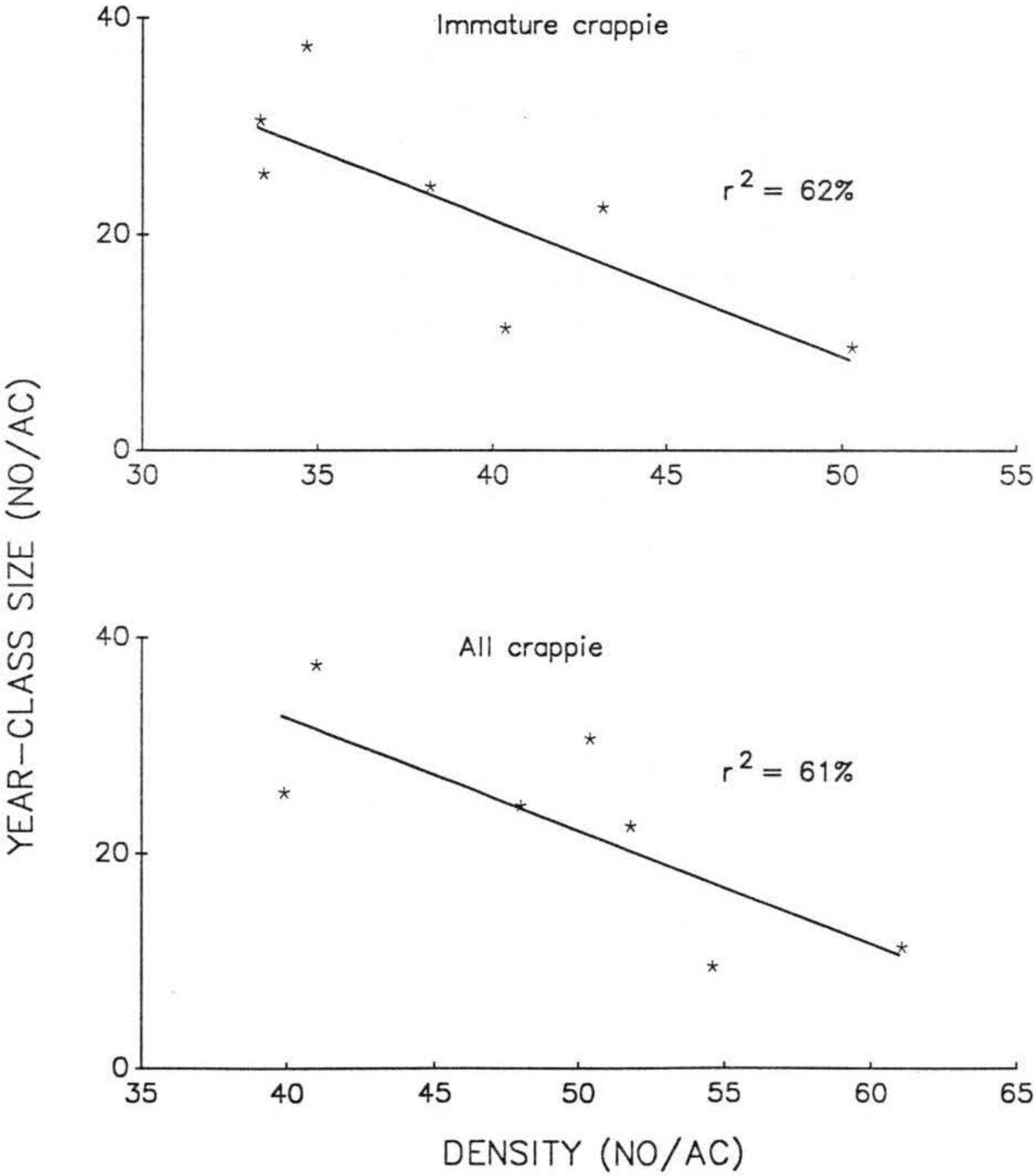
Table 9. Simple correlation coefficients for the relationships of inflow and elevation change parameters to the June meter net capture rates of crappie larvae. (Numbers in parenthesis are sample sizes in years).

	Inflow		Elevation Days
Reservoir	April-May	September-May	September-May
NIA	-0.12 (13)	-0.18 (13)	-0.22 (12)
PDT	0.29 (12)	-0.18 (12)	-0.00 (12)
SAC	0.03 (13)	-0.21 (13)	0.17 (12)
JRA	-0.18 (14)	-0.43 (14)	-0.34 (12)

Table 10. Spearman rank correlation coefficients for the relationships between several white crappie density parameters and the year-class-strength ratings on 5 Missouri reservoirs. (An asterisk indicates a significant correlation where $p \leq 0.05$).

Reservoir	Sample Size (Years)	Density Parameters			
		Yearling	Immature	Mature	Total
NIA	8	-0.32	-0.81*	0.25	-0.76*
PDT	9	-0.23	-0.30	0.05	-0.17
SAC	7	-0.66	0.28	-0.19	0.19
JRA	9	-0.06	0.06	-0.23	-0.14
WAP	6	0.28	-0.06	-0.12	-0.12

Figure 11. Relationships between the estimated density of immature (age I and II) and all white crappie (ages I-IV) in a given year to the size of the year class produced that year on the Niangua Arm of Lake of the Ozarks.



$Y = 72.4 - 1.28(X)$, and $Y = 74.3 - 1.04(X)$, where Y is the size of year class expressed as its harvest from age I-IV, and X is the density of immature and all crappie, respectively.

DISCUSSION

Changes in water levels and flow regimes were not significantly related to crappie year-class strength on the four Missouri reservoirs even though the parameters covered several different segments of an age group's first year of life. Large year classes were produced in all of the reservoirs in 1973, when inflows were high and water levels increased, but large year classes were also produced on Pomme de Terre and the James River Arm of Table Rock Lake in 1977, when these conditions were reversed (Appendix F). The inflow parameters calculated from Corps of Engineers' and Union Electric's data may not have accurately reflected the conditions affecting each year class because inflow data was for the entire reservoir while crappie year-class strength was usually rated on one arm. However, the water level parameters expressed as elevation days would still be applicable for all of the reservoirs as would the inflow data for Pomme de Terre Lake, where year-class strength was rated for the entire reservoir.

Increases in inflows and water levels probably have a positive influence on year-class strength, even though significant correlations were not found. It seems likely that, under certain conditions, this positive influence is masked or eliminated.

For example, one of the benefits of high water levels or inflows for crappie is probably increased production of zooplankton, which occurs when nutrients are released from flooded terrestrial vegetation or from allochthonous sources. These increased numbers of zooplankton would not result in a large year class, however, if no age-0 crappie were present to consume them. If the high inflow and resulting zooplankton

production happened too late in the year, high larval fish mortality might have already occurred.

Other conditions related to food availability could also mask the benefits of high inflows or water levels on year-class strength. High densities of other fishes (crappie or other species) could lead to competition for food and result in greater mortality of crappie larvae. Increased turbidity associated with the inflows could inhibit primary and ultimately zooplankton production, or make zooplankton unavailable to particulate-feeding larval fish.

The duration and magnitude of major inflow events may also affect year-class strength. Short-term flood events that cause rivers to rise above flood stage may be more beneficial than long-term high inflows during which the rivers stay within their channels. If this were the case, total inflow parameters would not adequately describe the conditions that produced a large year class.

The inverse relationship between immature crappie densities and year-class-strength for the Niangua Arm of Lake of the Ozarks agreed with the general concept of such relationships as reported in the literature. The mechanism for this relationship was not determined, but could be either competition between immature and age-0 crappie for food or actual predation on age-0 crappie. However, because this relationship was not significant for any of the other reservoirs, it cannot be determined if it is an actual cause-effect relationship.

Because the factors that influence year-class strength are complex, a multiple regression analysis would be an appropriate way to determine interactions. Multiple regression analyses using reservoir inflow, water level, and crappie stock parameters were not possible in this study because of the small number of years that had applicable data for each parameter.

Temperature is another factor that may affect year-class strength. Water temperature and the rate of temperature change influence the onset and duration of

spawning, maturation rate of eggs and larvae, metabolic rate of larvae, and production of zooplankton (Braum 1967 and Hokanson 1977). While age-0 fish can potentially grow faster in warmer water, a higher intake of food is also needed for both maintenance and growth. I examined surface water temperatures taken during the standard roving creel surveys to determine if relationships between temperature or rates of temperature increase were related to year-class strength of crappie. However, surface temperatures taken after mid-May, when most of the reservoirs began to stratify, did not accurately reflect the thermal conditions within the reservoirs, so further attempts to correlate them to year-class strength were not made. In order to determine the effect of temperature on year-class strength, profiles should be taken at standard locations and at frequent intervals throughout the first year of life.

It is likely that no one factor determines year-class strength of crappie each year, and that is why mortality patterns vary and significant relationships for the various parameters are difficult to demonstrate. If the reservoir inflow, water level, stock-recruitment, and temperature parameters are indeed important factors affecting year-class strength, then one of the mechanisms would likely be their influence on food production or on competition for food. Although zooplankton abundance and food habits of age-0 crappie were not studied extensively, some baseline zooplankton data were collected on several of the reservoirs, and food habits of larvae collected from the James River Arm of Table Rock Lake were examined (Appendix G).

Until more is known about the factors that determine year-class strength of white crappie, the management options are limited. Harvest of adult crappie can be controlled through regulations (Colvin 1982), but the recruitment to harvestable size will still vary, as will year-class strength. Stocking of hatchery-reared crappie to produce a year class may not be practical for large reservoirs because of the tremendous number of fish needed in some years. Also, factors that caused a small year class to be produced in a reservoir

might contribute to high mortality of stocked fish. Manipulating physical parameters such as water levels can be done, but the managing agency (usually the Corps of Engineers) should know that at the present time we can only speculate how it will affect year-class strength of crappie. However, water level management may have a more direct impact on recruitment of other important sport fishes such as black basses (Aggus and Elliot 1975; Novinger 1988).

RECOMMENDATIONS

Even though the factors that affect recruitment of crappie were not determined, the data collected provide a basis for future studies. Because the problem is so complex, sampling should be concentrated on one or two reservoirs and should examine the factors that affect recruitment of several important fishes such as crappies, white bass, and shad. Additional work on black basses could also be done. Sampling efforts should include most of the first year of life, because the data indicate that significant mortality may occur well after the first month, which is typically considered to be a critical period.

Sampling of age-0 fishes should include the upper and lower areas of the reservoirs as well as pelagic and littoral habitats. Food habits and food requirements for maintenance and growth of age-0 fishes should be determined to assess the impact of zooplankton populations on recruitment. It would also be helpful to age otoliths and assess mortality and growth of fish that hatched at different times. If different "cohorts" of age-0 fish exhibit different survival patterns, then factors important for their survival would be easier to identify.

Further studies of factors that influence year-class strength should emphasize, but not be limited to, those that may affect production of food for age-0 fish. Factors that

should be monitored include: inflow and outflow parameters (including river stages); reservoir water levels; temperature regimes; zooplankton species composition and size structure; and age-0 and adult fish densities and condition. Sampling should be extensive enough to monitor year-class development throughout the first year of life yet flexible enough to determine if major inflow or other events affect zooplankton production and possibly the survival of age-0 fish.

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APPENDIX A: ABBREVIATIONS USED IN TEXT AND APPENDIX TABLES

RESERVOIRS

CLW - Clearwater Lake

HST - Harry S. Truman Lake

JRA - James River Arm of Table Rock Lake

LCA - Long Creek Arm of Table Rock Lake

LOB - Long Branch Lake

NIA - Niangua Arm of Lake of the Ozarks

PDT - Pomme de Terre Lake

SAC - Sac Arm of Stockton Lake

SMV - Smithville Lake

THL - Thomas Hill Lake

WAP - Wappapello Lake

SPECIES

BLG - bluegill

GZS - gizzard shad

TFS - threadfin shad

WHB - white bass

AGE-0 CAPTURE RATES

MNTOT - Total number of crappie larvae captured per 1,000 m^3 with the meter net in June.

PER12 - Percent of the crappie larvae captured with the meter net in June that were 12 mm and longer.

PER18 - Percent of the crappie larvae captured with the meter net in June that were 18 mm and longer.

TOT12 - Total crappie larvae 12 mm and longer captured per 1,000 m^3 with the meter net in June.

TOT18 - Total crappie larvae 18 mm and longer captured per 1,000 m^3 with the meter net in June.

TRAP - Number of age-0 white crappie captured per trap-net day in October.

TRAWL - Number of age-0 crappie captured per 10,000 m^3 with the mid-water trawl in September.

HYDROLOGIC

APMAY - Total inflow into the reservoir in acre-feet X 10^6 during April and May.

APSEP - Total inflow into the reservoir in acre-feet X 10^6 from April through September.

SEPMA - Total inflow into the reservoir in acre-feet X 10^6 from the previous September through the following May.

OUTFLOW - Total outflow from the reservoir in acre-feet X 10^6 during May and June.

EDMAY - Change in elevation expressed as elevation-days from September 1 of the previous year through the following May.

EDAUG - Change in elevation expressed as elevation-days from September 1 of the previous year through the following August.

DENSITY PARAMETERS

ALL - Estimated density of crappie from age I-IV present at the start of the year.

YEARL - Estimated density of yearling (age I) crappie present at the start of the year.

IMMAT - Estimated density of immature crappie (ages I and II) present at the start of the year.

MATURE - Estimated density of mature crappie (ages III and IV) present at the start of the year.

HARV - A year-class's harvest from age I through age IV used as the best estimate of year-class size.

ZOOPLANKTON

BOSM - Bosmina spp

CALA - Calanoid

CERI - Ceriodaphnia spp

CHYD - Chydorus spp

CLAD - Cladocerans

COPE - Copepods

CYCL - Cyclopoid

DAPH - Daphnia spp

DIAP - Diaphanasoma spp

DIPT - Diptera

NAUP - Nauplii

PLEU - Pleuroxis spp

ROTI - Rotifers

Appendix B. Length frequencies of crappie larvae (number per 1,000 cubic meters) captured with the meter net for each sampling date from 1972 through 1986 on 10 Missouri reservoirs. (Approximately 3600 cubic meters of water were filtered on each date. Data for the Long Creek Arm of Table Rock Lake are from the main lake sampling areas).

		LENGTH GROUP (mm)											
RESERVOIR	DATE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
NIA	5-31-73	16.5	33.4	14.8	14.0	0.8								79.4
NIA	5-30-74	23.9	61.1	55.0	70.7	46.3	23.6	8.2						288.6
NIA	6-06-75	20.3	60.8	81.8	114.6	93.6	45.4	9.3	3.6	1.4	0.3	0.5		431.4
NIA	7-28-75													0.0
NIA	6-03-76	55.0	46.6	50.7	10.5	0.6								163.4
NIA	7-29-76													0.0
NIA	6-09-77	6.3	12.2	34.7	22.9	8.5	1.1	0.5	0.0	0.3				86.5
NIA	6-08-78	26.8	19.2	11.5	10.4	32.5	25.7	11.8	3.0	0.3				141.1
NIA	5-10-79	15.9												15.9
NIA	5-21-79	1704.7	884.7	512.4	60.8	1.6								3164.0
NIA	5-29-79	483.9	349.8	866.0	331.7	136.3	28.4	2.7						2198.8
NIA	6-18-79	8.8	32.5	74.9	279.1	361.3	382.5	234.7	118.2	74.9	31.1	6.3	1.4	1605.3
NIA	5-08-80	37.8	26.2											64.1
NIA	5-13-80	15.4	22.9	20.7										71.0
NIA	5-27-80	3.8	11.0	29.5	24.0	2.7								71.0
NIA	6-02-80	0.0	3.8	14.8	31.7	13.7	2.2							66.3
NIA	6-11-80	3.8	13.7	10.4	4.9	0.5	0.0	0.0	0.5					33.6
NIA	6-09-81	39.4	94.7	442.9	113.4	46.0	25.1	11.0	2.7	1.6	0.5			777.3
NIA	6-07-82	201.4	195.9	75.0	61.9	7.7	4.6	2.7	0.5					549.0
NIA	6-03-83	88.2	81.6	63.7	1.4									235.0
NIA	6-08-84	40.5	13.7	31.7	54.8	58.6	30.1	6.0						234.4
NIA	6-17-85	41.1	40.8	53.9	29.8	21.4	35.0	19.2	11.0	2.7	4.4	0.8	3.6	263.6
NIA	5-22-86	18.4	22.1	10.4	8.5	3.6	0.3							63.3
NIA	6-10-86	0.0	3.3	11.5	54.2	68.9	27.9	18.1	1.6	3.3	1.6			190.4

Appendix B. (Continued)

RESERVOIR	DATE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
PDT	5-30-73	4.6	14.1	57.9	43.0	16.5	3.6							139.7
PDT	5-29-74	40.5	187.8	88.1	75.8	26.5	3.8							422.5
PDT	6-05-75	54.0	38.0	49.0	45.1	23.2	6.3	2.7	0.3	0.6				219.2
PDT	7-29-75													0.0
PDT	6-02-76	22.1	276.9	167.5	189.2	34.5	6.0							696.3
PDT	7-28-76	0.0	0.0	0.0	0.5									0.5
PDT	6-07-78	144.0	151.0	166.7	116.7	91.2	70.7	42.4	6.6					789.2
PDT	6-07-79	53.9	238.5	351.4	945.9	1087.9	976.2	329.7	140.5	68.9	21.0	0.6	1.3	4216.1
PDT	6-10-80	21.4	37.2	35.6	20.7	13.7	3.3	2.2						134.1
PDT	6-04-81	26.8	12.1	6.0	3.3	5.5	1.1	1.6						56.4
PDT	6-03-82	195.5	212.9	426.4	353.1	255.1	138.5	30.6	8.8	0.5				1621.5
PDT	6-02-83	53.7	180.1	206.9	98.0	14.3								553.0
PDT	6-07-84	47.1	22.9	75.5	146.2	71.1	32.8	16.5	2.7					415.0
PDT	6-12-85	1.3	2.2	1.3	3.3	3.1	1.4	2.0	2.2	3.5	4.1	4.2	14.1	42.9
PDT	6-13-85	0.5	1.3	0.2	1.9	2.0	0.8	1.4	1.3	1.9	2.2	1.3	4.6	19.2
PDT	5-12-86	10.2	11.5	9.9	0.8									32.3
PDT	6-02-86	0.5	9.6	34.5	35.8	26.2	8.2	4.4	3.0	1.9	0.8	0.3	0.3	125.6
SAC	5-29-73	17.7	24.0	21.4	8.8	1.1								73.0
SAC	5-28-74	21.0	20.3	25.4	32.3	10.2	0.8							110.1
SAC	6-04-75	7.1	72.1	21.8	23.9	17.6	8.5	3.0	2.5					156.4
SAC	7-30-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1
SAC	6-01-76	24.3	31.4	111.6	90.9	38.3	8.5	1.1						306.2
SAC	7-27-76	0.0	0.0	0.0	0.0	0.5	1.1	1.6	2.2	4.9	3.8	3.3	18.7	36.0

Appendix B. (Continued)

		LENGTH GROUP (mm)												
RESERVOIR	DATE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
SAC	5-16-77	2.2	4.4	12.1	3.3									22.0
SAC	6-07-77	19.5	17.3	15.9	19.5	3.3	1.6							76.9
SAC	6-07-78	253.7	216.5	385.6	455.5	398.3	193.6	108.2	55.3	29.5	5.8	0.5		2102.4
SAC	6-06-79	43.2	105.7	313.7	246.3	118.2	17.0	3.8	1.1					849.1
SAC	6-09-80	116.3	336.9	242.4	105.0	87.3	83.4	68.3	26.2	13.2	5.2	0.6		1085.2
SAC	6-03-81	63.0	100.8	19.8	9.9	4.9	4.9	2.7	0.5					206.5
SAC	6-02-82	53.1	34.5	14.8	10.4	4.4								117.1
SAC	6-01-83	34.5	17.6	4.9	0.5									57.5
SAC	6-06-84	24.6	59.2	63.4	51.5	28.4	13.2	1.1						241.5
SAC	5-13-85	61.9	78.3	20.3	7.2	0.5								168.1
SAC	6-10-85	56.4	92.5	73.9	36.7	10.4	11.5	6.6	2.7	1.6	0.0	0.0	0.5	292.6
SAC	6-11-85	112.6	45.4	47.9	52.3	25.1	10.5	2.5	0.5					296.4
SAC	5-13-86	52.3	15.1	0.8										68.1
SAC	6-03-86	11.1	56.7	30.5	17.6	5.5	4.7	1.4	2.5	0.5				130.3
JRA	5-17-72													0.0
JRA	5-24-72	1.6	0.0	2.2										3.8
JRA	6-20-72													0.0
JRA	7-11-72													0.0
JRA	4-25-73													0.0
JRA	5-08-73	67.5	3.3											70.8
JRA	5-15-73	32.8	0.5											33.3
JRA	5-23-73	166.9	91.4	2.7	0.5									261.4
JRA	6-06-73	0.5	2.2	3.3	3.8	0.5								10.2
JRA	6-13-73	6.6	11.0	4.4	6.0	1.6	1.1	0.0	0.5					31.1
JRA	6-20-73	0.0	0.0	1.6	0.3	0.8	0.5	0.8	0.3	1.1	0.3			5.7
JRA	6-27-73	0.3	0.0	0.3	1.9	0.8	1.9	0.5	1.6	0.8	3.0	2.5	2.2	15.7

Appendix B. (Continued)

RESERVOIR	DATE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
JRA	4-17-74													0.0
JRA	4-30-74	2.4												2.4
JRA	5-07-74	7.7												7.7
JRA	5-13-74	1.6	2.7											4.2
JRA	5-27-74	0.3												0.3
JRA	6-04-74													0.0
JRA	6-13-74													0.0
JRA	5-01-75													0.0
JRA	5-06-75													0.0
JRA	5-14-75	0.3												0.3
JRA	5-21-75													0.0
JRA	5-27-75	1.4												1.4
JRA	6-03-75													0.0
JRA	6-11-75													0.0
JRA	6-25-75													0.0
JRA	7-31-75													0.0
JRA	4-21-76	5.2	0.5											5.7
JRA	5-04-76													0.0
JRA	5-12-76	13.7												13.7
JRA	5-17-76	1.6												1.6
JRA	5-25-76	0.8	1.1	0.3										2.2
JRA	5-31-76	3.6	1.1	0.3										5.0
JRA	6-09-76	0.3												0.3
JRA	6-15-76													0.0
JRA	6-23-76													0.0
JRA	7-26-76													0.0
JRA	4-13-77													0.0
JRA	4-26-77	7.7	3.8											11.5
JRA	5-04-77	26.1	78.5	10.2										114.8
JRA	5-10-77	33.0	39.4	76.3	42.7	3.5								194.8
JRA	5-18-77	0.0	2.0	24.5	25.4	11.6	18.8	4.6	0.3					87.3
JRA	5-25-77	0.0	1.6	5.2	6.6	13.2	6.3	0.8	1.4	0.3				35.3
JRA	6-06-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	0.5	10.4	12.7
JRA	6-28-77													0.0

Appendix B. (Continued)

		LENGTH GROUP (mm)												
RESERVOIR	DATE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
JRA	4-27-78	35.6	2.2											37.8
JRA	5-09-78	30.5	2.5											33.0
JRA	5-16-78	22.5	0.5											22.9
JRA	5-23-78	16.5	11.8	0.3										28.6
JRA	6-06-78	1.9	5.2	7.7	3.8	0.5								19.0
JRA	6-27-78													0.0
JRA	4-23-79													0.0
JRA	5-02-79	1.6												1.6
JRA	5-08-79	2.2	0.5											2.7
JRA	5-14-79	2.7	2.2	0.5										5.3
JRA	5-23-79	7.1	0.5											7.5
JRA	5-30-79	1.6	1.1	1.1	0.5									4.2
JRA	6-05-79	70.7	22.9	7.4	0.8	0.3	0.0	0.3						102.4
JRA	5-07-80	1.7												1.7
JRA	5-13-80	77.7	12.6	0.3										90.6
JRA	5-21-80	26.5	2.2	0.8										29.5
JRA	5-28-80	64.8	36.4	13.2	2.7									117.1
JRA	6-03-80	190.4	47.4	13.3	10.4	1.6	0.3							263.4
JRA	6-24-80	9.6	22.8	12.2	6.3	6.6	5.2	0.5						63.1
JRA	5-18-81	15.4	0.5											15.9
JRA	5-27-81	24.6	2.7											27.3
JRA	6-01-81	152.8	15.4	1.1										169.2
JRA	5-17-82	613.7	843.6	290.6	20.7									1768.6
JRA	5-25-82	296.1	504.8	483.4	195.9	37.8	4.4							1522.4
JRA	5-31-82	141.8	50.4	77.2	79.4	43.2	11.0	1.1						404.1
JRA	5-17-83	3.8												3.8
JRA	5-24-83	12.6	3.3											15.9
JRA	5-30-83	159.8	16.5	0.5										176.8
JRA	5-07-84													0.0
JRA	5-15-84	12.1	2.7											14.8
JRA	5-21-84	284.5	65.6	7.9										358.0
JRA	5-30-84	84.6	237.4	256.2	58.7	11.9	0.5							649.4
JRA	6-04-84	47.1	117.1	139.6	182.3	115.6	33.4	4.9						639.9

Appendix B. (Continued)

RESERVOIR	DATE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
JRA	5-22-85	24.0	7.5	33.6	11.3	1.4	0.2	0.2						78.2
JRA	6-05-85	63.9	38.6	15.4	6.9	3.3	0.6	1.6	0.0	0.2				130.5
JRA	6-06-85	128.1	22.5	6.0	0.8	0.2	0.2	0.0	0.2	0.2				157.9
JRA	5-15-86	16.5	11.8	17.6	1.1									46.8
JRA	6-11-86	1.6	0.5											2.2
LCA	4-18-72													0.0
LCA	5-01-72	42.7	1.3											44.0
LCA	5-04-72	125.0	7.1											132.0
LCA	5-08-72	61.7	8.3	1.9										71.9
LCA	5-11-72	85.6	11.9	2.2										99.7
LCA	5-15-72	52.9	18.7	7.5	0.9									80.1
LCA	5-18-72	14.8	15.5	6.2	2.6	0.3								39.5
LCA	5-22-72	6.6	1.0	2.6	1.6									11.8
LCA	5-25-72	29.0	7.7	12.2	2.8	0.3								52.1
LCA	5-30-72	37.5	5.2	2.2	2.5	1.6								49.0
LCA	6-01-72	39.1	3.6	0.9	2.5	0.3								46.5
LCA	6-05-72	16.2	2.8	0.9	1.6	0.9	0.3							22.8
LCA	6-07-72	6.6	3.5	1.3	0.6	0.3	0.6							12.9
LCA	6-12-72	4.4	3.8	3.0	0.5	0.3								11.9
LCA	6-14-72	1.6	1.1	0.8	0.8									4.2
LCA	6-19-72	0.6	0.0	0.3										0.9
LCA	6-29-72													0.0
LCA	7-06-72													0.0
LCA	4-18-73													0.0
LCA	5-07-73	188.5	49.7											238.2
LCA	5-09-73	84.9	20.1											105.0
LCA	5-14-73	203.9	134.9	73.7	0.7									413.2
LCA	5-16-73	207.2	103.6	107.9	7.6									426.3
LCA	5-22-73	118.4	74.0	33.2	21.4	3.6								250.6
LCA	5-24-73	47.0	73.7	26.6	15.5	5.6	0.3							168.7
LCA	5-28-73	13.5	23.7	34.2	27.3	24.7	8.6	0.3						132.3
LCA	6-05-73	8.9	3.0	10.5	32.9	40.5	40.1	21.4	7.6	0.3				165.2
LCA	6-07-73	8.6	4.9	3.6	6.6	13.5	18.4	11.8	6.2	1.6				75.2
LCA	6-12-73	2.3	5.6	3.3	0.7	0.7	4.3	2.0	1.3	2.0				22.2
LCA	6-14-73	2.8	7.5	3.8	1.1	0.0	0.3	0.0	1.1	2.8	0.9	0.3		20.7
LCA	6-19-73	2.4	3.5	2.7	1.4	1.1	1.1	1.4	0.3	2.0				15.9
LCA	6-26-73	0.3	0.0	0.3	0.3	0.6	0.3	0.0	0.3	0.0	0.3			2.5
LCA	7-03-73													0.0

Appendix B. (Continued)

RESERVOIR	DATE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
LCA	4-11-74													0.0
LCA	4-16-74													0.0
LCA	5-01-74	13.2	4.0	0.3										17.5
LCA	5-06-74	203.9	117.1	2.0										323.0
LCA	5-14-74	140.8	73.4	46.0	2.0									262.2
LCA	5-22-74	27.0	7.9	10.5	11.2									56.6
LCA	6-05-74	1.4	1.6	0.3										3.6
LCA	6-12-74	0.5	0.0	0.3	0.3	1.1								2.2
LCA	6-19-74	0.5	0.5	0.0	0.0	0.0	0.0	0.5						1.4
LCA	4-30-75	1.3												1.3
LCA	5-05-75	15.1	2.0											17.1
LCA	5-12-75	2.6	2.3	2.3										7.2
LCA	5-19-75	4.0	0.3	0.3										4.6
LCA	5-26-75	1.0	0.3											1.3
LCA	6-02-75	0.7	0.7	0.3										1.7
LCA	6-12-75													0.0
LCA	6-18-75													0.0
LCA	6-24-75													0.0
LCA	8-01-75													0.0
LCA	4-13-76													0.0
LCA	4-19-76	71.7	0.3											72.0
LCA	5-06-76	45.1	2.6	3.6										51.3
LCA	5-10-76	14.8	1.0	3.3	0.7									19.8
LCA	5-18-76	6.6	1.3	1.0	0.3									9.2
LCA	5-25-76	6.2	0.3	0.7										7.2
LCA	6-10-76	0.6												0.6
LCA	6-14-76	0.0	0.5	0.0	0.0	0.3								0.8
LCA	6-24-76													0.0
LCA	4-12-77													0.0
LCA	4-27-77	169.4	68.8											238.2
LCA	5-03-77	12.5	25.3	23.4	0.7									61.9
LCA	5-11-77	105.3	176.6	129.3	124.0	35.9								571.1
LCA	5-17-77	29.6	123.4	182.9	129.6	37.8	16.1	4.0						523.4
LCA	5-26-77	7.2	21.7	39.5	22.4	16.8	6.6	3.0	1.3					118.5
LCA	6-29-77													0.0

Appendix B. (Continued)

RESERVOIR	DATE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
LCA	4-26-78	55.3	1.0											56.3
LCA	5-10-78	19.7	3.0											22.7
LCA	5-15-78	18.8	16.4	6.9	0.3									42.4
LCA	5-24-78	54.6	17.1	10.5	7.9									90.1
LCA	6-26-78	5.5	33.9	144.6	174.1	41.6	4.4	0.0	0.0	1.1				405.2
LCA	4-22-79													0.0
LCA	5-07-79	4.6	1.9											6.4
LCA	5-15-79	1.9	8.5	3.9										14.3
LCA	5-22-79	7.2	5.2	4.6	2.7									19.6
LCA	5-31-79	3.9	1.3	8.5	4.6									18.2
LCA	6-04-79	2.0	3.3	4.6	5.3	0.8								16.0
LCA	5-06-80	4.6												4.6
LCA	5-14-80	108.3	45.4											153.7
LCA	5-20-80	33.4	38.2	1.3										72.8
LCA	5-29-80	83.4	40.0	7.9	3.3									134.5
LCA	6-01-80	84.8	111.6	37.4	13.8	0.6								248.2
LCA	6-23-80	1.6	11.5	3.3	1.6	2.5	0.0	0.8	0.8	0.0	0.0	0.0	0.8	22.8
LCA	5-19-81	381.7	120.3	214.1	29.5									745.6
LCA	5-26-81	277.9	63.7	19.8	11.8	4.6	0.6							378.4
LCA	6-02-81	143.2	133.3	24.3	11.1	8.5	1.3	0.6						322.3
LCA	5-18-82	58.1	35.0	6.0										99.1
LCA	5-24-82	504.8	581.8	271.5	25.1	1.1								1384.3
LCA	6-01-82	482.8	755.5	279.1	117.6	57.1	30.1	9.3						1731.6
LCA	5-18-83	95.3	31.6											126.9
LCA	5-23-83	386.8	96.6	0.6										484.0
LCA	5-31-83	147.1	92.0	44.6	10.5									294.2
LCA	5-08-84	3.3												3.3
LCA	5-14-84	70.7	6.6											77.2
LCA	5-22-84	36.7	20.1	4.9										61.7
LCA	5-29-84	340.5	298.3	249.6	84.3	9.3								982.0
LCA	6-05-84	603.5	390.9	186.4	67.4	18.1	2.5							1268.7
LCA	5-21-85	39.1	44.6	25.4	9.6	5.2								123.9
LCA	6-04-85	58.2	113.7	124.0	111.2	48.4	11.8	4.7	1.1	0.6				473.7

Appendix B. (Continued)

		LENGTH GROUP (mm)												
RESERVOIR	DATE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
LCA	5-15-86	43.5	32.5	21.4	4.4									101.9
LCA	6-12-86	11.1	23.9	19.9	18.4	3.8	1.6							78.8
THL	6-02-73	4.9	22.9	57.5	25.7	3.3	1.1							115.4
THL	6-01-74	12.6	19.2	14.0	2.4	1.7	1.6	0.6						52.0
THL	6-07-75	3.3	3.0	1.7	3.0	2.7	1.3	0.5	1.3	2.4	0.0	0.5		19.3
THL	7-27-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	7.7	8.8
THL	6-04-76	19.2	12.6	14.4	24.6	6.9	1.9							79.6
THL	8-03-76													0.0
THL	6-10-77	8.2	2.4	0.6	0.3	0.0	0.3	0.3	0.0	0.9	0.9	0.9	0.3	15.2
THL	6-09-78	285.3	64.5	122.6	367.9	326.9	50.9	46.5	58.1	63.4	57.0	22.5	13.2	1478.6
THL	6-14-79	0.0	0.0	0.5	0.0	3.3	2.7	4.4	2.7	4.9	14.8	17.0	29.0	79.4
THL	6-18-80													0.0
THL	6-08-81	0.0	1.1	2.7	1.1									4.9
THL	6-10-82	0.0	0.5	0.0	0.0	0.0	0.5							1.1
THL	6-12-84	0.0	0.0	0.0	0.5									0.5
THL	5-31-85	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3	0.6	0.3			2.4
THL	6-05-85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.5	0.5	0.8	3.3
THL	6-13-85	0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1
THL	6-19-85	0.0	0.0	0.3	0.3	0.0	0.3	0.3	0.0	0.0	0.0	0.0	3.3	4.4
THL	6-25-85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6
THL	5-20-86	0.0	0.3	0.8	3.0	1.6	1.6	1.1	1.4	1.1	0.8			11.8
THL	6-05-86	0.0	0.5	0.0	0.3	0.3	0.0	0.0	0.3	0.3	0.5	1.4	10.7	14.3
HST	6-19-84	24.3	29.5	64.4	65.2	19.5	22.1	14.0	8.5	4.9	0.0	0.5		252.9
WAP	6-14-77	0.0	0.5	0.5	5.5	4.4	7.7	30.1	48.2	41.6	48.2	47.6	164.2	399.1
WAP	6-15-77	0.0	0.0	0.0	0.0	0.0	0.0	6.6	26.2	78.8	59.2	62.3	302.2	535.4
WAP	6-13-78	9.9	30.1	16.5	46.8	69.6	50.4	30.5	16.6	3.3	1.9	0.3	0.3	275.8

Appendix B. (Continued)

		LENGTH GROUP (mm)												
RESERVOIR	DATE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	-24-	>26	TOTAL
WAP	6-12-79	37.8	218.4	950.0	487.8	582.2	537.9	341.6	56.7	14.8	7.4	1.6	2.5	3238.6
WAP	6-17-80	0.8	14.8	14.0	7.4	13.2	6.6	11.5	1.6					69.9
WAP	6-11-81	3.8	45.4	56.4	59.7	37.2	14.3	5.5	0.5	0.5				223.4
CLW	6-15-77	14.4	120.3	270.0	160.3	113.4	33.1	7.5	2.0	1.3	0.9	0.6		723.9
CLW	6-14-78	92.0	121.5	10.8	0.9									225.3
CLW	6-11-79	13.2	32.2	47.9	74.9	114.9	113.0	61.7	23.7	5.2	4.6	2.0		493.3
CLW	6-16-80	140.4	205.4	87.9	14.0	9.9	7.4	1.6						466.4
CLW	6-10-81	527.7	696.3	693.6	492.2	84.3	17.6	8.2	5.5					2525.2
CLW	6-08-82	399.1	226.7	60.8	7.7	2.7								696.9
LOB	6-17-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.3	2.2	6.6	24.0	37.2
SMV	6-18-85	4.7	8.8	14.8	4.7	1.4	1.4							35.8

Appendix C. Capture rates (number per 10,000 cubic meters) of fishes sampled with the mid-water trawl from 1972 through 1981 on seven Missouri reservoirs. (At least 43,000 cubic meters of water were filtered each night. Age I+ includes Age I and older).

RESERVOIR	DATE	AGE-0 CRAPPIE	AGE-I+ CRAPPIE	AGE-0 GZS	AGE-I+ GZS	AGE-0 TFS	AGE-I+ TFS	SILVER-SIDES	AGE-0 SUNFISH	AGE-I+ BLG	AGE-0 WHB	AGE-0 CATFISH	AGE-I+ CARP	LOGPERCH
NIA	9-20-73	7.0	6.0	43.0	2.0	0.0	0.0	0.8	8.0	0.0	0.0	0.0	0.0	0.0
NIA	9-20-74	0.8	2.0	115.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIA	7-28-75	0.0	12.0	490.0	9.0	0.0	0.0	7.0	17.0	0.0	2.0	0.0	0.0	0.0
NIA	9-11-75	0.0	7.0	88.0	5.0	36.0	0.0	2.0	4.0	0.0	2.0	0.0	0.0	0.0
NIA	7-28-76	0.0	3.0	88.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIA	9-12-76	0.6	3.0	69.0	36.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIA	9-22-77	0.2	0.6	44.4	3.2	16.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
NIA	9-07-78	0.5	1.0	268.0	3.0	0.0	0.0	0.5	19.0	0.0	0.0	0.0	0.0	0.0
NIA	9-01-81	2.0	3.0	26.0	0.0	121.0	0.0	2.0	42.0	0.0	0.0	0.0	0.0	0.0
PDT	9-19-73	2.0	1.0	9.0	2.0	0.0	0.0	1.0	0.2	0.0	0.0	0.0	0.0	0.0
PDT	9-19-74	0.0	2.0	62.0	11.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
PDT	7-29-75	0.0	4.0	1412.0	1.0	0.0	0.0	3.0	5.0	0.0	0.0	0.0	0.0	0.0
PDT	9-10-75	0.0	0.9	405.0	3.0	0.0	0.0	0.7	0.0	0.2	0.0	0.0	0.0	0.0
PDT	7-28-76	0.0	0.0	1257.0	0.0	0.0	0.0	16.0	16.0	0.0	0.0	0.0	0.0	0.2
PDT	9-14-76	0.0	0.4	576.0	2.0	0.0	0.0	2.0	0.1	0.1	0.0	0.0	0.0	0.2
PDT	9-21-77	2.0	0.4	19.0	0.8	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
PDT	9-06-78	0.0	0.7	391.0	0.9	0.0	0.0	0.7	23.0	0.2	0.0	0.0	0.0	0.0
PDT	7-28-81	0.0	3.0	889.0	0.8	103.0	0.0	119.0	100.0	0.3	0.0	0.0	0.0	0.0
SAC	9-18-73	1.0	4.0	495.0	20.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.3	0.0
SAC	9-18-74	0.0	4.0	858.0	52.0	0.0	0.0	6.0	0.0	0.1	0.0	0.0	0.0	0.0
SAC	7-30-75	0.0	3.0	2219.0	3.0	0.0	0.0	0.3	0.8	0.0	0.0	0.0	0.0	0.0
SAC	9-09-75	0.0	1.0	622.0	2.0	0.0	0.0	0.2	0.6	0.2	0.0	0.0	0.0	0.0
SAC	7-27-76	6.0	2.0	517.0	2.0	0.0	0.0	15.0	9.0	0.0	0.0	0.0	0.0	0.0
SAC	9-15-76	0.3	3.0	1540.0	2.0	0.0	0.0	9.0	0.0	0.1	0.0	0.0	0.0	0.0

Appendix C. (continued)

RESERVOIR	DATE	AGE-0 CRAPPIE	AGE-I+ CRAPPIE	AGE-0 GZS	AGE-I+ GZS	AGE-0 TFS	AGE-I+ TFS	SILVER-SIDES	AGE-0 SUNFISH	AGE-I+ BLG	AGE-0 WHB	AGE-0 CATFISH	AGE-I+ CARP	LOGPERCH
SAC	9-20-77	0.8	2.0	587.0	1.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
SAC	9-05-78	0.0	0.0	1561.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
SAC	7-27-81	0.7	6.0	2793.0	4.0	0.0	0.0	43.0	37.0	0.7	0.0	0.0	0.0	0.0
JRA	7-11-72	0.0	0.0	9011.0	454.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	8-22-72	0.0	0.0	17087.0	0.0	0.0	700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	10-17-72	0.0	0.0	2080.0	129.0	0.0	424.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	6-27-73	27.0	0.0	2397.0	7.0	0.0	0.0	1.0	0.0	0.0	70.0	0.0	0.0	0.0
JRA	7-11-73	10.0	0.0	7496.0	63.0	0.0	118.0	2.0	2.0	0.0	57.0	1.0	0.0	0.0
JRA	8-01-73	3.0	0.0	4363.0	4.0	0.0	15.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
JRA	8-07-73	1.0	0.0	1250.0	0.0	0.0	3.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0
JRA	8-14-73	2.0	0.0	1190.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
JRA	8-22-73	3.0	0.0	2866.0	0.0	0.0	16.0	0.0	0.0	0.0	5.0	0.2	0.0	0.0
JRA	9-17-73	0.7	0.4	1131.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
JRA	6-04-74	0.0	0.5	0.0	0.5	0.0	80.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	6-13-74	0.0	0.0	0.0	0.5	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	6-27-74	0.0	0.0	28.0	0.0	0.0	4.0	0.0	0.0	0.9	0.0	0.5	0.0	0.0
JRA	7-10-74	0.0	0.0	363.0	0.0	0.0	58.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	9-17-74	0.0	0.5	2067.0	1.0	282.0	4.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0
JRA	6-11-75	0.0	1.0	557.0	0.5	64.0	503.0	0.2	0.0	0.7	0.5	0.0	0.0	0.5
JRA	6-25-75	0.0	0.7	541.0	2.0	0.0	135.0	0.0	0.0	0.7	0.0	0.2	0.0	0.0
JRA	7-08-75	0.0	3.0	6320.0	1.0	0.0	983.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
JRA	7-31-75	0.0	2.0	3510.0	53.0	0.0	528.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
JRA	6-08-76	0.0	0.0	0.0	0.2	0.0	795.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	6-14-76	0.0	0.0	1.0	0.7	0.0	711.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	6-22-76	0.0	0.0	101.0	34.0	0.0	309.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
JRA	6-30-76	0.0	0.0	708.0	0.0	0.0	2195.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
JRA	7-25-76	0.0	0.3	8737.0	0.0	0.0	1807.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
JRA	9-15-76	0.0	0.0	7763.0	0.0	0.0	70.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
JRA	6-28-77	0.2	0.0	2783.0	0.0	0.0	0.0	0.0	0.0	0.0	43.0	2.0	0.0	0.0
JRA	7-12-77	0.0	0.0	5787.0	0.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0
JRA	8-04-77	0.7	0.0	1067.0	0.0	0.0	0.0	0.2	0.2	0.0	20.0	0.0	0.0	0.0
JRA	9-19-77	0.2	0.0	1833.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
JRA	9-04-78	0.0	2.0	29.0	31.0	0.0	0.0	1.0	22.0	0.7	0.0	0.7	0.0	0.0
JRA	7-23-81	0.0	0.0	14880.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C. (continued)

RESERVOIR	DATE	AGE-0 CRAPPIE	AGE-I+ CRAPPIE	AGE-0 GZS	AGE-I+ GZS	AGE-0 TFS	AGE-I+ TFS	SILVER-SIDES	AGE-0 SUNFISH	AGE-I+ BLG	AGE-0 WHB	AGE-0 CATFISH	AGE-I+ CARP	LOGPERCH
LCA	7-06-72	0.0	0.0	29.0	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	7-12-72	0.0	0.0	443.0	14.0	0.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	7-20-72	0.0	0.0	375.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	8-21-72	0.0	0.0	0.0	0.0	130.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-26-73	0.0	0.0	214.0	56.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	7-03-73	0.0	5.0	17162.0	264.0	0.0	0.0	37.0	0.0	0.0	51.0	5.0	0.0	0.0
LCA	7-10-73	2.0	0.0	630.0	0.0	0.0	0.0	12.0	2.0	0.0	9.0	0.0	0.0	0.0
LCA	7-26-73	0.0	0.0	4383.0	624.0	0.0	0.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	7-31-73	0.0	0.0	544.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
LCA	8-08-73	0.0	0.0	560.0	3.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	8-13-73	0.2	0.0	123.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	8-23-73	0.0	0.0	2218.0	162.0	0.0	0.0	17.0	0.0	0.0	0.5	0.0	0.0	0.0
LCA	6-05-74	0.0	0.0	0.0	0.9	0.0	672.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-12-74	0.0	0.0	0.0	0.0	0.5	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-19-74	0.0	0.0	0.0	0.0	0.9	155.0	0.0	0.0	0.0	0.5	0.9	0.0	0.0
LCA	6-26-74	0.0	0.0	0.0	0.0	101.0	22.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
LCA	7-11-74	0.0	0.0	0.0	0.0	25.0	9.0	1.0	2.0	0.0	0.0	1.0	0.0	0.0
LCA	9-16-74	0.0	0.0	0.0	0.0	150.0	5.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-18-75	0.0	0.0	0.0	0.0	170.0	0.9	0.0	0.2	0.0	0.0	0.2	0.0	0.0
LCA	6-24-75	0.0	0.0	0.0	0.0	193.0	1.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0
LCA	7-07-75	0.0	0.0	0.0	0.0	805.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	9-08-75	0.0	0.0	0.0	0.0	863.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-10-76	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-14-76	0.0	0.0	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-24-76	0.0	0.0	0.0	0.3	16.0	110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	6-29-76	0.0	0.0	0.0	0.0	240.0	12.0	0.2	0.0	0.0	0.5	0.0	0.0	0.0
LCA	7-26-76	0.0	0.0	0.0	0.0	4506.0	0.3	7.0	0.8	0.0	0.5	0.0	0.0	0.0
LCA	6-29-77	0.0	0.0	0.0	0.0	295.0	0.0	0.7	1.0	0.0	0.9	0.0	0.0	0.0
THL	9-21-73	24.0	3.0	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	8-14-74	240.0	0.0	106.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
THL	9-05-74	20.0	0.9	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	9-24-74	8.0	14.0	73.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	7-27-75	0.0	14.0	313.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	9-16-75	54.0	13.0	6.0	0.0	178.0	0.0	0.0	2.0	0.0	0.0	0.0	0.3	0.0

Appendix C. (continued)

RESERVOIR	DATE	AGE-0 CRAPPIE	AGE-I+ CRAPPIE	AGE-0 GZS	AGE-I+ GZS	AGE-0 TFS	AGE-I+ TFS	SILVER-SIDES	AGE-0 SUNFISH	AGE-I+ BLG	AGE-0 WHB	AGE-0 CATFISH	AGE-I+ CARP	LOGPERCH
THL	8-03-76	0.0	22.0	0.0	0.0	15486.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2	0.0
THL	9-22-76	0.0	4.0	0.0	0.5	9616.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	9-23-77	0.0	0.7	0.4	0.0	3261.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	9-08-78	1.0	1.0	2479.0	6.0	0.0	0.0	0.0	29.0	0.8	0.0	0.0	0.0	0.0
THL	7-19-81	0.0	11.0	3.0	29.0	66.0	48.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0
WAP	9-06-77	29.0	2.0	52.0	2.0	0.0	0.0	0.9	14.0	0.9	0.0	0.0	0.0	0.0
WAP	7-21-81	0.0	0.5	76.0	8.0	2.0	0.0	42.0	281.0	0.0	0.0	0.0	0.0	0.0
CLW	9-07-77	0.9	0.9	15.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
CLW	7-20-81	0.0	6.0	63.0	0.0	64.0	0.0	12.0	2.0	0.0	0.0	0.0	0.0	0.0

Appendix D. Capture rates (number per 1,000 cubic meters) of larval fishes (other than crappie) collected with the meter net from 1972 through 1986 on 10 Missouri reservoirs.

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
NIA	05-31-73	3792.0	19.9	8.2	3.8	0.0	0.0	0.0	0.0	14.3
NIA	05-30-74	3673.5	56.4	61.4	75.0	0.3	0.0	0.0	0.0	15.2
NIA	06-06-75	1544.3	0.3	136.3	4.1	0.0	0.0	0.0	0.3	1.4
NIA	07-28-75	6.6	0.0	583.6	0.5	1.1	0.5	0.0	0.0	0.0
NIA	06-03-76	7158.4	13.2	113.8	1.7	0.0	0.0	0.0	0.0	6.3
NIA	07-29-76	4.9	0.0	490.0	0.5	0.0	0.0	0.0	0.0	0.5
NIA	06-09-77	2551.2	0.0	184.8	10.2	0.5	0.0	0.0	0.0	0.3
NIA	06-08-78	16753.5	152.4	302.7	956.6	0.3	0.0	7.4	0.0	13.8
NIA	05-10-79	6.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	3.2
NIA	05-21-79	13001.8	234.6	0.0	10.4	0.0	0.0	0.0	0.0	63.0
NIA	05-29-79	25403.1	328.4	13.2	23.6	0.0	0.0	12.1	0.0	35.0
NIA	06-18-79	3399.5	13.5	107.7	484.3	0.0	3.3	0.0	0.0	1.1
NIA	05-08-80	116.7	16.5	0.0	0.0	0.0	0.0	0.0	0.0	1.6
NIA	05-13-80	336.6	8.8	0.0	0.0	0.0	0.0	0.0	0.0	3.8
NIA	05-27-80	184.0	2.2	0.0	1.1	0.5	0.0	0.0	0.0	2.2
NIA	06-02-80	198.1	0.5	43.2	0.0	0.0	0.0	0.0	0.0	0.0
NIA	06-11-80	1037.9	0.0	452.2	0.5	0.0	0.5	0.0	0.0	0.0
NIA	06-09-81	7166.9	1144.0	26.2	5.5	0.5	0.0	0.0	0.0	4.9
NIA	06-07-82	5504.3	20.3	53.1	128.1	1.1	0.0	0.0	0.0	8.7
NIA	06-03-83	1771.7	34.2	0.0	0.0	0.0	0.0	44.6	0.0	6.1
NIA	06-08-84	840.9	7.7	3.3	86.5	0.0	0.0	44.6	0.0	1.6
NIA	06-17-85	5554.3	1.4	28.4	121.5	0.3	0.5	11.1	0.0	3.6
NIA	05-22-86	5505.2	36.7	20.3	2.2	0.0	0.0	0.8	0.0	0.5
NIA	06-10-86	712.8	108.3	9.9	6.6	0.0	0.0	0.0	0.0	0.0
PDT	05-30-73	2812.8	23.2	2.5	1.6	0.0	0.0	0.0	0.0	0.5
PDT	05-29-74	10534.2	0.3	27.3	2.2	0.0	0.0	1.1	0.0	0.0

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
PDT	06-05-75	6799.8	0.0	207.2	19.9	0.0	0.0	0.6	0.0	0.3
PDT	07-29-75	124.8	0.0	276.9	0.0	1.6	0.0	0.0	0.0	0.0
PDT	06-02-76	3103.9	1.9	43.0	14.8	0.3	0.0	0.0	0.0	0.8
PDT	07-28-76	811.8	0.0	105.7	0.0	1.1	0.0	0.0	0.0	0.0
PDT	06-08-77	1367.9	0.0	210.2	8.2	1.6	1.6	8.2	0.0	0.0
PDT	06-07-78	7761.9	51.5	152.1	87.9	0.3	0.0	0.5	0.0	3.2
PDT	06-07-79	2441.7	9.9	54.5	46	0.0	0.0	0.0	0.0	2.6
PDT	06-10-80	989.6	0.0	163.6	7.5	0.0	0.0	0.9	0.0	0.0
PDT	06-04-81	517.9	6.0	3.9	0.3	0.3	0.0	0.0	0.0	0.3
PDT	06-03-82	6297.1	0.6	2.7	52.9	0.0	0.0	5.7	0.0	0.9
PDT	06-02-83	2897.3	25.3	0.0	14.8	0.0	0.0	0.0	0.0	1.6
PDT	06-07-84	3811.0	5.2	0.6	6.6	0.0	0.0	6.6	0.0	0.0
PDT	06-12-85	1241.6	0.6	47.6	28.7	1.1	0.2	24.2	0.0	33.9
PDT	06-13-85	1985.0	1.9	9.9	17.6	0.5	0.0	9.1	0.0	20.6
PDT	05-12-86	462.1	1.1	0.0	4.7	0.0	0.0	0.8	0.0	2.5
PDT	06-02-86	1355.7	2.7	26.1	2.7	0.5	0.0	0.3	0.0	1.1
SAC	05-29-73	703.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
SAC	05-28-74	1995.9	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
SAC	06-04-75	902.1	0.0	18.7	0.3	0.0	0.0	0.0	0.0	0.3
SAC	07-30-75	554.1	0.0	419.3	0.0	1.1	0.0	0.0	0.0	0.0
SAC	06-01-76	1993.1	0.0	12.1	0.0	2.2	0.0	0.0	0.0	0.3
SAC	07-27-76	718.3	0.0	67.8	0.0	0.0	0.0	0.0	0.0	0.0
SAC	05-16-77	832.1	0.0	0.0	1.1	0.0	0.0	1.1	0.0	1.1
SAC	06-07-77	13854.2	0.0	537.3	2.5	0.0	0.0	0.0	0.0	0.3
SAC	06-07-78	3296.8	0.0	67.8	4.1	0.3	0.0	0.0	0.0	0.8

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
SAC	06-06-79	1977.9	0.0	11.0	2.2	0.0	0.0	0.0	0.0	0.0
SAC	06-09-80	4036.6	0.0	104.4	6.0	0.0	0.0	0.0	0.0	0.6
SAC	06-03-81	1986.1	0.5	0.0	8.8	0.0	0.0	0.0	0.0	3.2
SAC	06-02-82	4974.4	6.0	22.9	42.7	0.0	0.0	0.0	0.0	0.5
SAC	06-01-83	1203.2	14.8	0.5	0.0	0.0	0.0	0.0	0.5	0.5
SAC	06-06-84	1625.3	2.7	1.1	0.5	0.0	0.0	1.6	0.5	0.5
SAC	05-13-85	1353.5	16.5	0.2	0.0	0.0	0.0	0.0	0.0	1.3
SAC	06-10-85	1094.9	0.0	25.1	0.0	0.0	0.0	3.8	0.0	0.0
SAC	06-11-85	1762.0	0.2	81.3	0.5	0.2	0.0	7.9	0.0	0.2
SAC	05-13-86	162.7	3.3	0.0	0.0	0.0	0.0	0.0	0.0	1.9
SAC	06-03-86	948.4	3.8	1.4	1.1	0.3	0.0	0.3	0.0	0.3
JRA	05-17-72	38.9	2.7	0.5	0.0	0.0	0.0	0.0	0.0	10.4
JRA	05-24-72	180.7	2.2	1.1	0.0	0.0	0.0	0.5	0.0	3.8
JRA	06-20-72	2395.5	0.5	0.0	0.0	0.0	13.2	0.0	0.0	0.0
JRA	07-11-72	763.2	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0
JRA	04-25-73	127.6	3.3	0.0	0.0	30.5	0.0	156.7	0.0	92.5
JRA	05-08-73	1921.8	92.0	0.0	0.0	0.0	0.0	5.7	0.0	2.9
JRA	05-15-73	405.7	21.8	0.0	0.0	0.0	0.0	9.3	0.0	47.6
JRA	05-23-73	2045.1	42.1	0.0	0.0	0.0	0.0	0.5	0.0	89.2
JRA	06-06-73	356.4	9.9	1.1	0.0	0.0	0.0	0.0	0.0	1.6
JRA	06-13-73	2673.6	17.0	3.3	0.0	0.0	0.0	3.3	0.0	0.5
JRA	06-20-73	2620.0	21.7	14.0	0.0	0.3	8.8	0.0	0.3	0.3
JRA	06-27-73	2626.5	9.9	8.5	0.0	0.0	13.7	0.0	0.0	0.3
JRA	04-17-74	1.3	1.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0
JRA	04-30-74	434.4	30.1	0.0	0.0	0.0	0.0	0.0	0.3	19.4
JRA	05-07-74	104.9	4.1	0.0	0.0	0.0	0.0	0.0	0.3	34.2
JRA	05-13-74	344.6	0.8	0.0	0.0	0.0	0.0	0.0	0.0	28.4
JRA	05-27-74	561.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5
JRA	06-04-74	1052.4	0.0	2.2	0.0	0.0	0.5	0.0	0.0	6.1
JRA	06-13-74	533.5	0.0	0.0	0.0	0.0	1.4	18.1	0.0	1.9

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
JRA	05-01-75	91.7	13.7	0.0	0.0	0.0	0.0	0.5	0.0	25.7
JRA	05-06-75	52.6	36.1	0.0	0.0	0.0	0.0	0.0	0.0	43.0
JRA	05-14-75	1205.1	57.1	0.0	0.0	0.0	0.0	0.0	0.0	157.6
JRA	05-21-75	1120.8	4.1	0.0	0.0	0.0	0.0	0.0	0.0	58.9
JRA	05-27-75	724.7	9.3	1.6	0.0	0.0	0.0	0.0	0.0	44.6
JRA	06-03-75	1529.2	0.0	1.4	0.0	0.0	0.0	0.0	0.0	5.2
JRA	06-11-75	3181.6	0.3	5.2	0.0	0.0	2.7	0.0	0.0	3.9
JRA	06-25-75	3028.8	0.0	33.1	0.0	0.3	17.3	1.4	0.0	0.6
JRA	07-31-75	1612.7	0.0	3.3	0.0	0.3	9.3	0.0	0.0	0.0
JRA	04-21-76	0.0	0.5	0.0	2.7	0.0	0.0	13.7	0.0	17.6
JRA	05-04-76	2.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	22.5
JRA	05-12-76	9.9	3.6	0.0	0.0	0.0	0.0	0.0	0.0	24.0
JRA	05-17-76	13.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	21.7
JRA	05-26-76	231.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	115.6
JRA	05-31-76	1250.3	0.5	1.9	0.0	0.3	0.0	0.3	0.0	45.5
JRA	06-09-76	1053.8	0.3	4.9	0.3	0.0	0.0	0.0	0.0	6.8
JRA	06-15-76	1304.2	0.0	1.6	0.0	0.0	2.2	0.0	0.0	1.4
JRA	06-23-76	825.2	0.0	0.0	0.0	0.0	8.2	0.0	0.0	1.0
JRA	07-26-76	1899.5	0.0	3.8	0.0	0.0	6.6	0.0	0.0	0.0
JRA	04-13-77	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	2.2
JRA	04-26-77	1308.6	55.6	0.0	0.3	0.0	0.0	0.0	0.0	9.1
JRA	05-04-77	5828.9	302.2	0.0	0.0	0.0	0.0	0.0	0.0	50.4
JRA	05-10-77	6251.3	808.9	0.0	0.0	0.0	0.0	0.0	0.0	57.6
JRA	05-18-77	14869.3	168.1	3.6	0.0	0.0	0.0	0.3	0.0	2.7
JRA	05-25-77	7115.4	18.4	2.7	0.0	0.0	0.0	0.0	0.0	1.1
JRA	06-06-77	3460.0	57.5	29.0	0.0	0.0	9.9	0.0	0.0	3.0
JRA	06-28-77	174.6	8.2	27.9	0.0	0.5	0.0	0.0	0.0	0.0
JRA	04-27-78	318.4	134.9	0.0	0.0	0.0	0.0	0.0	0.0	18.4
JRA	05-09-78	1215.8	9.1	0.0	0.0	0.0	0.0	2.5	0.0	23.7
JRA	05-16-78	2003.8	1.6	3.8	0.0	0.0	0.0	1.9	0.0	58.9
JRA	05-23-78	14949.5	49.8	0.0	0.0	0.0	0.0	0.5	0.0	87.6
JRA	06-06-78	2366.5	1.6	3.8	0.0	0.0	0.0	0.0	0.0	12.5
JRA	06-27-78	3352.9	0.0	50.9	0.0	1.1	13.2	0.0	0.0	2.1

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
JRA	04-23-79	6.0	550.1	0.0	0.0	0.0	0.0	0.0	0.0	3.2
JRA	05-02-79	774.0	293.9	0.0	0.0	0.0	0.0	0.0	0.0	8.2
JRA	05-08-79	1050.0	68.5	0.0	0.0	0.0	0.0	3.8	0.0	28.4
JRA	05-14-79	10260.3	80.5	0.0	0.0	0.0	0.0	0.0	0.0	66.7
JRA	05-23-79	931.2	1.1	0.0	0.0	0.0	0.0	26.2	0.0	22.5
JRA	05-30-79	1602.3	1.1	0.0	0.0	0.0	0.0	17.0	0.0	23.4
JRA	06-05-79	4985.8	64.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0
JRA	05-07-80	68.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
JRA	05-14-80	2059.4	47.9	0.0	0.0	0.0	0.0	0.0	0.0	21.7
JRA	05-21-80	2970.6	7.4	0.5	0.0	0.0	0.0	0.0	0.0	14.4
JRA	05-28-80	1173.4	12.1	0.0	0.0	0.0	0.0	0.0	0.0	55.6
JRA	06-03-80	7156.4	6.6	19.5	0.0	0.0	0.0	0.0	0.0	15.4
JRA	06-24-80	2699.6	0.0	14.0	0.0	0.0	1.1	0.0	0.0	0.0
JRA	05-18-81	1627.0	0.5	0.0	0.0	0.0	0.0	2.2	0.0	15.9
JRA	05-27-81	14824.7	95.3	0.0	0.0	0.0	1.1	0.0	0.0	11.5
JRA	06-01-81	4191.1	48.2	2.2	0.0	0.0	0.0	0.0	0.0	13.2
JRA	05-17-82	7505.1	387.0	0.0	0.0	0.0	0.0	0.0	0.5	93.6
JRA	05-25-82	3344.3	116.0	18.7	0.0	0.0	0.0	0.0	0.0	32.8
JRA	05-31-82	4457.7	12.1	33.9	0.0	0.0	0.0	0.0	0.0	4.9
JRA	05-17-83	617.5	25.7	0.0	0.0	0.0	0.0	0.0	0.0	2.2
JRA	05-24-83	787.2	24.0	0.0	0.0	0.0	0.0	0.0	0.0	24.0
JRA	05-30-83	1095.4	3.8	0.0	0.0	0.0	0.0	0.0	0.0	50.4
JRA	05-07-84	196.6	827.2	0.0	0.0	0.0	0.0	0.0	0.0	36.6
JRA	05-15-84	656.3	86.5	0.0	0.0	0.0	0.0	0.0	0.0	11.5
JRA	05-21-84	4074.2	147.7	0.0	0.0	0.0	0.0	0.0	0.0	32.2
JRA	05-30-84	13811.4	128.9	0.5	0.0	0.0	0.0	0.8	0.0	90.8
JRA	06-04-84	5075.7	231.6	0.5	0.0	0.0	0.0	2.7	0.0	1.1
JRA	05-22-85	3738.0	2.5	1.4	0.0	0.2	0.0	1.1	0.0	10.2
JRA	06-05-85	1960.0	1.4	23.6	0.0	0.2	10.8	0.6	0.0	7.2
JRA	06-06-85	4487.8	0.6	14.6	0.0	0.0	10.2	10.0	0.0	11.5
JRA	05-15-86	1994.2	270.4	0.0	0.0	0.0	0.0	0.3	0.0	44.1
JRA	06-11-86	2136.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
LCA	04-18-72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
LCA	05-01-72	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.2
LCA	05-04-72	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.6
LCA	05-08-72	2.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	2.2
LCA	05-11-72	2.5	1.9	0.0	0.0	0.0	0.0	0.0	0.0	2.2
LCA	05-15-72	24.6	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6
LCA	05-18-72	51.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.6
LCA	05-22-72	144.9	2.2	0.0	0.0	0.3	0.0	0.0	0.0	0.6
LCA	05-25-72	247.7	0.6	69.4	0.0	0.9	0.0	0.3	0.0	2.2
LCA	05-30-72	297.0	1.6	161.1	0.0	1.3	0.0	6.4	0.0	0.9
LCA	06-01-72	463.8	0.3	26.5	0.0	4.6	0.0	0.3	0.0	0.3
LCA	06-05-72	279.9	0.0	38.2	0.0	11.0	0.0	0.6	0.0	1.9
LCA	06-07-72	160.5	0.0	16.5	0.0	5.3	0.3	0.0	0.0	0.6
LCA	06-12-72	155.1	0.0	19.8	0.0	1.1	0.0	0.0	0.0	0.0
LCA	06-14-72	197.0	0.0	25.4	0.0	0.3	0.3	0.0	0.0	0.3
LCA	06-19-72	243.7	0.3	7.4	0.0	0.5	0.5	0.0	0.0	0.0
LCA	06-29-72	555.6	0.0	116.7	0.0	1.1	0.0	0.0	0.0	0.0
LCA	07-06-72	1373.3	0.0	32.3	0.0	0.8	1.6	0.0	0.0	0.0
LCA	04-18-73	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3
LCA	05-07-73	41.9	37.2	0.0	0.0	0.0	0.0	3.9	0.0	4.9
LCA	05-09-73	25.6	12.2	0.0	0.0	0.0	0.0	3.0	0.0	15.2
LCA	05-14-73	283.9	34.9	0.0	0.0	0.0	0.0	3.6	0.0	2.8
LCA	05-16-73	284.2	60.8	0.0	0.0	0.0	0.0	3.3	0.0	7.4
LCA	05-22-73	440.1	36.4	0.0	0.0	0.0	0.0	0.0	0.0	8.6
LCA	05-24-73	424.7	29.4	0.0	0.0	0.0	0.0	0.3	0.0	12.2
LCA	05-28-73	674.6	48.4	0.0	0.0	0.0	0.0	0.0	0.0	5.2
LCA	06-05-73	1733.3	29.0	0.3	0.0	0.0	0.0	0.0	0.0	0.9
LCA	06-07-73	514.2	7.2	0.6	0.0	0.0	0.0	0.0	0.0	0.3
LCA	06-12-73	1083.8	1.3	6.1	0.0	0.0	0.0	0.3	0.0	0.6
LCA	06-14-73	435.2	0.8	9.1	0.0	0.0	0.0	0.3	0.0	0.0
LCA	06-19-73	1839.1	0.3	33.1	0.0	0.0	0.3	0.0	0.0	0.0
LCA	06-26-73	1496.7	0.0	46.5	0.0	0.0	5.5	0.3	0.0	0.3
LCA	07-03-73	78.3	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
LCA	04-11-74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	04-16-74	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6
LCA	05-01-74	3.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	12.9
LCA	05-06-74	11.6	14.3	0.0	0.0	0.0	0.0	0.0	0.0	15.5
LCA	05-14-74	97.5	11.3	0.0	0.0	0.0	0.0	0.0	0.0	5.2
LCA	05-22-74	171.0	1.6	0.0	0.0	0.0	0.0	3.1	0.0	6.9
LCA	06-05-74	520.6	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.3
LCA	06-12-74	327.7	0.0	0.3	0.0	0.0	0.5	0.0	0.0	0.3
LCA	06-19-74	620.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.3
LCA	04-30-75	1.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
LCA	05-05-75	15.2	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9
LCA	05-12-75	9.1	5.5	0.0	0.3	0.0	0.0	0.0	0.0	1.3
LCA	05-19-75	52.3	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.9
LCA	05-26-75	328.8	3.6	240.2	0.0	0.0	0.0	0.0	0.0	0.6
LCA	06-02-75	433.6	1.6	26.5	0.0	0.6	0.0	0.0	0.0	1.2
LCA	06-12-75	908.2	0.0	53.2	0.0	0.3	3.3	0.0	0.0	0.6
LCA	06-18-75	1627.1	0.0	11.0	0.0	0.8	0.3	0.0	0.0	0.3
LCA	06-24-75	2490.5	0.0	89.5	0.0	0.5	1.1	0.0	0.0	0.0
LCA	08-01-75	555.6	0.0	0.5	0.0	1.1	0.0	0.0	0.0	0.0
LCA	04-13-76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
LCA	04-19-76	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	6.1
LCA	05-06-76	0.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	2.5
LCA	05-10-76	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
LCA	05-18-76	37.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	05-25-76	355.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.3
LCA	06-10-76	97.2	0.6	1.3	0.0	0.0	0.0	0.0	0.0	0.0
LCA	06-14-76	92.8	0.3	6.6	0.0	0.0	0.3	0.0	0.0	1.1
LCA	06-24-76	1000.4	0.0	12.1	0.0	0.0	9.6	0.0	0.0	1.0
LCA	04-12-77	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	04-27-77	73.3	5.5	0.0	0.0	0.0	0.0	0.0	0.0	3.9
LCA	05-03-77	125.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	2.5
LCA	05-11-77	2117.3	180.9	0.0	0.0	0.0	0.0	0.0	0.0	15.2
LCA	05-17-77	3011.7	50.7	21.0	0.0	0.0	0.0	0.0	0.0	4.8
LCA	05-26-77	3945.4	3.6	133.8	0.0	1.6	0.0	0.0	0.0	0.6
LCA	06-29-77	107.4	0.5	428.5	0.0	2.4	0.9	0.0	0.0	0.0

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
LCA	04-26-78	0.6	88.2	0.0	0.0	0.0	0.0	0.0	0.0	2.5
LCA	05-10-78	71.0	22.6	0.0	0.0	0.0	0.0	3.6	0.0	14.7
LCA	05-15-78	328.1	28.7	0.0	0.0	0.0	0.0	43.3	0.0	11.0
LCA	05-24-78	977.2	22.0	30.0	0.0	0.0	0.0	0.0	0.0	11.0
LCA	06-26-78	221.2	0.0	54.2	0.0	3.8	0.5	0.0	0.0	0.0
LCA	04-22-79	0.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-07-79	206.3	25.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-15-79	2875.3	6.6	0.0	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-22-79	3219.4	8.5	0.0	0.0	0.0	0.0	0.0	0.0	2.7
LCA	05-31-79	2319.5	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	06-04-79	2315.6	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
LCA	05-06-80	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-15-80	411.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.2
LCA	05-20-80	576.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
LCA	05-29-80	631.3	2.7	2.0	0.0	0.0	0.0	0.0	0.0	0.6
LCA	06-02-80	480.9	0.6	28.9	0.0	0.0	0.0	0.0	0.0	0.0
LCA	06-23-80	867.1	0.0	10.7	0.0	0.0	8.2	21.4	0.0	0.0
LCA	05-19-81	964.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	05-26-81	1807.1	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6
LCA	06-02-81	1532.6	2.0	0.6	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-18-82	233.8	2.7	0.0	0.0	0.0	0.0	0.0	0.0	3.3
LCA	05-24-82	2433.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	2.7
LCA	06-01-82	8348.0	0.0	93.9	0.0	0.0	0.0	0.6	0.0	0.0
LCA	05-18-83	192.8	22.9	0.0	0.0	0.0	0.0	0.0	0.0	2.7
LCA	05-23-83	1152.2	48.7	0.0	0.0	0.0	0.0	0.0	0.0	2.0
LCA	05-31-83	1196.2	31.6	0.0	0.0	0.0	0.0	0.0	0.0	1.3
LCA	05-08-84	175.2	95.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	05-14-84	169.1	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCA	05-22-84	1148.9	9.6	0.0	0.0	0.0	0.0	0.0	0.0	3.3
LCA	05-29-84	6097.7	71.1	0.0	0.5	0.0	0.0	0.0	0.0	3.3
LCA	06-05-84	5738.8	13.2	1.7	0.0	0.0	0.0	0.0	0.0	0.9
LCA	05-21-85	474.1	6.0	0.8	0.0	0.0	0.0	0.0	0.0	0.5
LCA	06-04-85	1773.2	1.6	0.0	0.0	0.0	1.1	0.0	0.0	0.0
LCA	05-15-86	679.7	15.9	0.0	0.0	0.0	0.0	0.0	0.0	6.3
LCA	06-12-86	2814.1	0.0	41.9	0.0	0.0	0.3	1.1	0.0	0.5

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
THL	06-02-73	209.6	0.0	1.6	0.0	0.0	0.5	0.0	0.0	0.0
THL	06-01-74	1324.6	0.0	0.0	0.0	0.0	0.6	0.6	0.0	1.3
THL	06-07-75	797.9	0.0	0.3	0.0	0.0	0.9	0.0	0.0	0.0
THL	07-27-75	47.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THL	06-04-76	13962.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
THL	08-03-76	589.1	0.0	2.2	0.0	0.0	1.1	0.0	0.0	0.0
THL	06-10-77	3544.6	0.0	22.9	0.0	0.0	2.4	0.0	0.0	0.0
THL	06-09-78	39039.3	0.0	17.0	0.5	0.0	0.0	2.2	0.0	0.5
THL	06-14-79	1080.0	0.0	1.1	1.1	0.0	0.5	6.6	0.0	0.0
THL	06-18-80	2646.2	0.0	12.1	1.1	0.0	0.5	0.0	0.0	0.0
THL	06-08-81	1683.4	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
THL	06-10-82	9104.1	0.0	2.2	28.4	0.0	0.5	0.5	0.0	0.0
THL	06-12-84	2072.6	0.0	0.5	272.6	0.0	0.0	2.2	0.0	0.0
THL	05-31-85	2080.4	0.0	0.0	571.2	0.0	0.9	0.0	0.0	0.0
THL	06-05-85	1180.0	0.0	0.0	721.3	0.0	0.0	0.3	0.0	0.0
THL	06-13-85	512.1	0.0	0.0	204.3	0.0	2.5	0.0	0.0	0.0
THL	06-19-85	803.4	0.0	0.0	69.9	0.0	2.5	0.3	0.0	0.0
THL	06-25-85	787.2	0.0	0.0	17.0	0.0	5.8	0.0	0.0	0.0
THL	05-20-86	3789.0	0.0	0.3	120.7	0.0	0.0	0.5	0.0	0.0
THL	06-05-86	3152.9	0.0	3.3	183.1	0.0	1.1	0.0	0.0	0.0
HST	06-19-84	18422.9	0.5	62.2	97.7	0.0	0.0	6.9	0.0	0.0
WAP	06-14-77	275.4	0.0	1412.4	0.0	11.5	1.6	0.0	0.0	3.3
WAP	06-15-77	105.0	0.0	1517.4	0.0	3.3	0.0	0.0	0.0	3.3
WAP	06-13-78	15617.6	0.0	27943.8	6.6	31.7	3.8	6.3	0.0	12.1
WAP	06-12-79	3042.3	4.1	713.6	1.6	2.5	0.0	0.0	0.0	41.9
WAP	06-17-80	1215.3	0.0	9085.0	16.5	191.4	1.6	3.3	0.0	19.8
WAP	06-11-81	7145.5	1.6	961.8	0.5	7.1	0.0	0.0	0.0	7.7

Appendix D. (continued)

RESERVOIR	DATE	SHAD	WHITE BASS	SUNFISH	DRUM	SILVER-SIDES	CATFISH	CARP	WALLEYE	OTHER
CLW	06-15-77	1108.3	0.3	234.6	0.0	7.9	2.4	0.0	0.0	0.0
CLW	06-14-78	1872.7	0.0	63.7	0.0	25.7	4.7	0.0	0.0	1.9
CLW	06-11-79	356.7	34.9	22.3	0.0	22.3	0.0	0.0	0.0	0.0
CLW	06-16-80	5732.4	0.0	193.0	0.0	0.0	2.5	0.0	0.0	0.0
CLW	06-10-81	10705.8	77.7	21.8	0.0	6.6	0.0	0.0	0.0	0.0
CLW	06-08-82	2286.5	0.0	102.4	0.0	0.5	0.0	0.0	0.0	3.8
LOB	06-17-82	2767.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
SMV	06-18-85	3950.7	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0

Appendix E. Capture rates of crappie larvae (number per 1,000 cubic meters) in the spawning cove and the adjacent main lake study areas (open water) on the Long Creek Arm of Table Rock Lake. When sample sizes were large enough, chi-square tests for differences in length-frequency distributions are indicated as being either significant (S) or not significant (NS). (Only dates when crappie larvae were captured are included in this table).

		LENGTH GROUP (mm)											
DATE	TYPE	-4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	TOTAL	CHI SQUARE
05-18-72	OPEN	14.8	15.5	6.2	2.6	0.3						39.5	S
05-18-72	COVE	131.6	52.6	52.6								236.8	
05-22-72	OPEN	6.6	1.0	2.6	1.6							11.8	
05-22-72	COVE	144.7	111.8	26.3	26.3							309.1	
05-07-73	OPEN	188.5	49.7									238.2	NS
05-07-73	COVE	105.3	19.7									125.0	
05-09-73	OPEN	84.9	20.1									105.0	S
05-09-73	COVE	269.7	230.3	6.6								506.6	
05-14-73	OPEN	203.9	134.9	73.7	0.7							413.2	S
05-14-73	COVE	1815.8	282.9	322.4								2421.1	
05-16-73	OPEN	207.2	103.6	107.9	7.6							426.3	S
05-16-73	COVE	1710.5	171.1	256.6								2138.2	
05-22-73	OPEN	118.4	74.0	33.2	21.4	3.6						250.6	NS
05-22-73	COVE	1276.3	1032.9	500.0	315.8	32.9						3157.9	
05-24-73	OPEN	47.0	73.7	26.6	15.5	5.6	0.3					168.7	S
05-24-73	COVE	1671.1	809.2	638.2	546.1	322.4						3987.0	
05-28-73	OPEN	13.5	23.7	34.2	27.3	24.7	8.6	0.3				132.3	S
05-28-73	COVE	210.5	78.9	197.4	177.6	111.8	13.2					789.4	
06-05-73	OPEN	8.9	3.0	10.5	32.9	40.5	40.1	21.4	7.6	0.3		165.2	S
06-05-73	COVE	335.5	6.6	0.0	6.6	46.1	46.1	52.6	19.7	13.2		526.4	
06-07-73	OPEN	8.6	4.9	3.6	6.6	13.5	18.4	11.8	6.2	1.6		75.2	
06-07-73	COVE	131.6	26.3	0.0	0.0	13.2	0.0	13.2				184.3	
06-12-73	OPEN	2.3	5.6	3.3	0.7	0.7	4.3	2.0	1.3	2.0		22.2	
06-12-73	COVE	26.3	0.0	6.6	0.0	0.0	0.0	0.0	6.6	6.6	26.3	72.4	
05-01-74	OPEN	13.2	4.0	0.3								17.5	
05-01-74	COVE	480.3	32.9									513.2	

Appendix E. (continued)

DATE	TYPE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	TOTAL	CHI SQUARE
05-06-74	OPEN	203.9	117.1	2.0								323.0	S
05-06-74	COVE	1171.1	236.8	13.2								1421.1	
05-14-74	OPEN	140.8	73.4	46.0	2.0							262.2	S
05-14-74	COVE	131.6	32.9	59.2	6.6							230.3	
05-22-74	OPEN	27.0	7.9	10.5	11.2							56.6	S
05-22-74	COVE	407.9	39.5	78.9	26.3							552.6	
04-30-75	OPEN	1.3										1.3	
04-30-75	COVE	19.7										19.7	
05-05-75	OPEN	15.1	2.0									17.1	NS
05-05-75	COVE	605.3	39.5									644.8	
05-12-75	OPEN	2.6	2.3	2.3								7.2	
05-12-75	COVE	72.4	59.2	32.9								164.5	
05-19-75	OPEN	4.0	0.3	0.3								4.6	
05-19-75	COVE	355.3	0.0	6.6								361.9	
05-26-75	OPEN	1.0	0.3									1.3	
05-26-75	COVE	6.6										6.6	
06-02-75	OPEN	0.7	0.7	0.3								1.7	
06-02-75	COVE	0.0	6.6	19.7								26.3	
04-19-76	OPEN	71.7	0.3									72.0	
04-19-76	COVE	3177.6										3177.6	
05-06-76	OPEN	45.1	2.6	3.6								51.3	S
05-06-76	COVE	1375.0	13.2	32.9								1421.1	
05-10-76	OPEN	14.8	1.0	3.3	0.7							19.8	
05-10-76	COVE	157.9	6.6	6.6								171.1	
05-18-76	OPEN	6.6	1.3	1.0	0.3							9.2	
05-18-76	COVE	144.7	13.2									157.9	
05-25-76	OPEN	6.2	0.3	0.7								7.2	
05-25-76	COVE	78.9	46.1	13.2								138.2	

Appendix E. (continued)

DATE	TYPE	LENGTH GROUP (mm) -4-	-6-	-8-	-10-	-12-	-14-	-16-	-18-	-20-	-22-	TOTAL	CHI SQUARE
04-27-77	OPEN	169.4	68.8									238.2	S
04-27-77	COVE	4460.5	552.6									5013.1	
05-03-77	OPEN	12.5	25.3	23.4	0.7							61.9	S
05-03-77	COVE	605.3	789.5	388.2								1783.0	
05-11-77	OPEN	105.3	176.6	129.3	124.0	35.9						571.1	S
05-11-77	COVE	644.7	276.3	190.8	72.4							1184.2	
05-17-77	OPEN	29.6	123.4	182.9	129.6	37.8	16.1	4.0				523.4	S
05-17-77	COVE	52.6	210.5	131.6	65.8	19.7	6.6					486.8	
05-26-77	OPEN	7.2	21.7	39.5	22.4	16.8	6.6	3.0	1.3			118.5	
05-26-77	COVE	6.6	0.0	13.2	6.6							26.4	
04-26-78	OPEN	55.3	1.0									56.3	NS
04-26-78	COVE	203.9	6.6									210.5	
05-10-78	OPEN	19.7	3.0									22.7	NS
05-10-78	COVE	1013.2	250.0	65.8								1329.0	
05-15-78	OPEN	18.8	16.4	6.9	0.3							42.4	NS
05-15-78	COVE	210.5	157.9	105.3								473.7	
05-24-78	OPEN	54.6	17.1	10.5	7.9							90.1	S
05-24-78	COVE	631.6	250.0	131.6	26.3							1039.5	

Appendix F. Data used in regression analyses. (See Appendix A for definition of abbreviations. "M" indicates missing data. "tr"= less than 1%).

RESERVOIR	YEAR CLASS	RATING	HARV	METER NET MNTOT	TOT12	PER12	TOT18	PER18	TRAWL	TRAP
NIA	1973	3	M	79	1	1	0	0	7.0	3.6
NIA	1974	2	20.8	289	78	27	0	0	0.8	1.6
NIA	1975	2	17.3	431	154	36	6	1	0.0	2.1
NIA	1976	2	24.0	163	10	tr	0	0	0.6	4.4
NIA	1977	1	10.9	86	10	12	tr	tr	0.2	0.6
NIA	1978	2	25.2	141	73	52	3	2	0.5	2.8
NIA	1979	3	30.2	1605	1210	75	232	14	M	6.4
NIA	1980	1	9.1	66	16	24	1	2	M	0.3
NIA	1981	3	37.0	777	87	11	5	1	2.0	4.9
NIA	1982	2	22.1	549	16	3	1	tr	M	1.1
NIA	1983	1	M	235	0	0	0	0	M	0.1
NIA	1984	M	M	234	95	40	0	0	M	1.1
NIA	1985	M	M	264	98	37	22	8	M	0.5
NIA	1986	M	M	190	121	64	6	3	M	2.5

RESERVOIR	YEAR CLASS	INFLOW APMAY	APSEP	SEPMA	OUT-FLOW	ELEVATION DAYS EDMAY	EDAUG	CRAPPIE DENSITIES YEARL	IMMAT	MATURE	ALL
NIA	1973	6.26	7.88	6.26	3.14	M	M	M	M	M	M
NIA	1974	1.52	3.55	10.12	1.48	264	334	M	M	M	M
NIA	1975	1.40	3.06	9.44	1.08	-9	-39	M	M	M	M
NIA	1976	1.12	2.02	3.34	0.74	-668	-890	17.3	38.1	9.8	47.9
NIA	1977	0.45	2.12	8.47	0.82	-1203	-1158	24.0	40.3	20.7	61.0
NIA	1978	2.59	3.49	5.67	1.45	-75	-30	10.9	33.4	6.4	39.8
NIA	1979	1.62	3.62	3.76	1.51	-608	-792	25.2	33.3	17.0	50.3
NIA	1980	1.48	1.81	2.96	0.28	-630	-888	30.2	50.2	4.3	54.5
NIA	1981	0.75	4.69	1.15	1.88	-270	-144	9.1	34.6	6.3	40.9
NIA	1982	1.26	4.53	5.31	2.16	-303	-1275	37.0	43.1	8.6	51.7
NIA	1983	4.41	6.76	7.98	4.77	-352	-374	22.1	53.0	2.5	55.5
NIA	1984	2.08	3.74	6.69	2.43	147	-380	M	M	M	M
NIA	1985	3.03	6.61	10.32	2.96	484	M	M	M	M	M
NIA	1986	M	M	M	M	M	M	M	M	M	M

Appendix F. (continued)

RESERVOIR	YEAR CLASS	RATING	HARV	METER NET MNTOT	TOT12	PER12	TOT18	PER18	TRAWL	TRAP
PDT	1973	3	M	140	20	14	0	0	2.0	M
PDT	1974	1	M	422	30	7	0	0	0.0	0.2
PDT	1975	1	13.0	219	33	15	1	tr	0.0	0.1
PDT	1976	1	13.2	696	40	6	0	0	0.0	0.3
PDT	1977	3	46.2	M	M	M	M	M	2.0	2.2
PDT	1978	1	13.6	789	210	27	7	1	0.0	0.0
PDT	1979	3	41.9	4216	2626	62	232	6	M	2.1
PDT	1980	1	8.1	134	19	14	0	0	M	0.1
PDT	1981	2	23.3	56	8	15	0	0	M	1.3
PDT	1982	2	24.0	1622	434	27	9	1	M	0.3
PDT	1983	1	12.5	553	14	3	0	0	M	0.1
PDT	1984	1	M	415	123	30	3	1	M	0.8
PDT	1985	M	M	43	35	81	28	7	M	0.7
PDT	1986	M	M	126	45	36	6	5	M	M

RESERVOIR	YEAR CLASS	INFLOW APMAY	APSEP	SEPMA	OUT-FLOW	ELEVATION DAYS EDMAY	EDAUG	CRAPPIE DENSITIES YEARL	IMMAT	MATURE	ALL
PDT	1973	0.25	0.29	0.84	0.34	1456	1974	M	M	M	M
PDT	1974	0.05	0.14	0.47	0.54	756	1014	M	M	M	M
PDT	1975	0.05	0.11	0.53	0.11	274	172	M	M	M	M
PDT	1976	0.09	0.13	0.28	0.49	169	184	13.0	24.3	19.7	44.0
PDT	1977	0.02	0.17	0.04	0.07	-152	148	13.2	22.4	8.2	30.6
PDT	1978	0.14	0.17	0.29	0.47	207	592	46.2	58.0	4.8	62.8
PDT	1979	0.21	0.26	0.39	0.21	687	1047	13.6	44.7	5.0	49.7
PDT	1980	0.06	0.06	0.20	0.01	45	-114	41.9	51.1	7.4	58.5
PDT	1981	0.07	0.24	0.11	0.09	-123	434	8.1	47.6	3.7	51.3
PDT	1982	0.06	0.12	0.25	0.08	74	96	23.3	29.6	18.2	47.8
PDT	1983	0.25	0.28	0.47	0.23	556	804	21.1	40.1	3.6	43.7
PDT	1984	0.17	0.20	0.63	0.09	807	936	12.5	31.6	8.2	39.8
PDT	1985	0.10	0.26	0.64	0.14	1000	M	M	M	M	M
PDT	1986	M	0.15	M	M	M	M	M	M	M	M

Appendix F. (continued)

RESERVOIR	YEAR CLASS	RATING	HARV	METER NET MNTOT	TOT12	PER12	TOT18	PER18	TRAWL	TRAP
SAC	1973	3	M	73	1	2	0	0	1.0	M
SAC	1974	2	M	110	11	10	0	0	0.0	M
SAC	1975	3	M	156	32	20	2	2	0.0	0.1
SAC	1976	3	37.7	306	48	16	0	0	0.3	0.8
SAC	1977	2	10.9	77	5	6	0	0	0.8	0.4
SAC	1978	3	23.7	2102	791	38	91	4	0.0	0.7
SAC	1979	1	3.0	849	140	16	1	tr	M	0.1
SAC	1980	3	15.7	1085	284	26	45	4	M	0.9
SAC	1981	1	5.1	206	13	6	1	tr	M	0.9
SAC	1982	2	6.5	117	4	4	0	0	M	0.2
SAC	1983	2	7.6	58	0	0	0	0	M	2.6
SAC	1984	2	M	242	43	18	0	0	M	0.0
SAC	1985	M	M	293	33	11	5	2	M	0.2
SAC	1986	M	M	130	15	11	3	2	M	0.5

RESERVOIR	YEAR CLASS	INFLOW APMAY	APSEP	SEPMA	OUT-FLOW	ELEVATION DAYS EDMAY	EDAUG	CRAPPIE DENSITIES YEARL	IMMAT	MATURE	ALL
SAC	1973	0.47	0.59	1.55	0.81	1437	1980	M	M	M	M
SAC	1974	0.13	0.41	1.03	0.17	1210	1668	M	M	M	M
SAC	1975	0.15	0.28	1.06	0.13	963	1127	M	M	M	M
SAC	1976	0.17	0.30	0.44	0.11	-206	-317	M	M	M	M
SAC	1977	0.05	0.20	0.11	0.00	-1572	-2118	M	M	M	M
SAC	1978	0.25	0.34	0.60	0.10	1204	2408	10.9	45.1	15.3	60.4
SAC	1979	0.36	0.60	0.66	0.37	-470	66	23.7	30.5	17.4	47.9
SAC	1980	0.13	0.16	0.41	0.16	-147	-441	3.0	24.6	6.8	31.4
SAC	1981	0.06	0.32	0.11	0.01	-272	338	15.7	18.6	9.2	27.8
SAC	1982	0.12	0.32	0.51	0.04	108	418	5.1	19.5	2.4	21.9
SAC	1983	0.46	0.58	0.87	0.41	-284	-162	6.5	10.8	4.0	14.2
SAC	1984	0.32	0.39	1.11	0.30	952	1556	7.6	13.5	2.4	15.9
SAC	1985	0.24	0.41	1.16	0.23	M	M	M	M	M	M
SAC	1986	M	M	M	M	M	M	M	M	M	M

Appendix F. (continued)

RESERVOIR	YEAR CLASS	RATING	HARV	METER NET MNTOT	TOT12	PER12	TOT18	PER18	TRAWL	TRAP
JRA	1973	3	21.8	10	1	5	0	0	0.7	2.7
JRA	1974	1	1.0	0	0	0	0	0	0.0	0.0
JRA	1975	1	1.0	0	0	0	0	0	M	0.1
JRA	1976	1	1.0	5	0	0	0	0	0.0	tr
JRA	1977	3	23.5	13	13	100	13	100	0.2	14.2
JRA	1978	2	8.0	19	1	3	0	0	0.2	0.1
JRA	1979	3	21.4	102	1	1	0	0	M	0.8
JRA	1980	1	2.2	263	2	1	0	0	M	0.9
JRA	1981	1	1.0	169	0	0	0	0	M	tr
JRA	1982	2	9.1	404	55	14	0	0	M	0.1
JRA	1983	1	M	177	0	0	0	0	M	M
JRA	1984	2	M	640	154	24	0	0	M	M
JRA	1985	M	M	130	6	4	tr	tr	M	M
JRA	1986	M	M	2	0	0	0	0	M	M

RESERVOIR	YEAR CLASS	INFLOW APMAY	APSEP	SEPMA	OUT-FLOW	ELEVATION DAYS EDMAY	EDAUG	CRAPPIE DENSITIES YEARL	IMMAT	MATURE	ALL
JRA	1973	2.11	3.13	4.84	M	2331	4453	M	M	M	M
JRA	1974	0.49	1.96	3.04	M	-111	295	21.8	22.8	3.0	25.8
JRA	1975	0.72	1.29	4.07	M	448	276	1.0	20.8	1.0	21.8
JRA	1976	0.72	1.72	1.67	M	922	1568	1.0	2.0	8.0	10.0
JRA	1977	0.24	0.64	1.02	0.10	-1443	-2101	1.0	2.0	5.0	7.0
JRA	1978	1.04	1.81	2.82	0.90	1101	2483	23.5	24.5	2.0	26.5
JRA	1979	1.30	2.17	2.49	0.80	-764	-480	8.0	31.5	1.0	32.5
JRA	1980	0.32	0.68	1.28	0.39	-934	-1682	21.4	29.4	18.5	47.9
JRA	1981	0.25	1.06	0.48	0.64	-1218	-706	2.2	23.6	18.0	41.6
JRA	1982	0.36	1.15	1.68	0.37	486	974	1.0	3.2	27.0	30.2
JRA	1983	1.06	1.73	2.98	0.65	-292	-487	M	M	M	M
JRA	1984	0.90	1.32	2.32	0.51	-177	99	M	M	M	M
JRA	1985	1.00	1.73	4.94	0.68	M	M	M	M	M	M
JRA	1986	0.82	1.30	3.02	M	M	M	M	M	M	M

Appendix F. (continued)

RESERVOIR	YEAR CLASS	RATING	HARV	METER NET MNTOT	TOT12	PER12	TOT18	PER18	TRAWL	TRAP
WAP	1976	3	M	M	M	M	M	M	M	14.8
WAP	1977	2	17.5	399	392	98	350	88	M	7.8
WAP	1978	2	16.5	276	173	63	22	8	M	0.4
WAP	1979	2	16.8	3239	1545	48	83	3	M	4.3
WAP	1980	1	8.9	70	33	47	2	2	M	2.7
WAP	1981	3	24.8	223	58	26	1	tr	M	5.6
WAP	1982	3	39.5	M	M	M	M	M	M	5.9
WAP	1983	3	27.1	M	M	M	M	M	M	15.0

RESERVOIR	YEAR CLASS	INFLOW APMAY	APSEP	SEPMA	OUT-FLOW	ELEVATION DAYS EDMAY	EDAUG	CRAPPIE DENSITIES YEARL	IMMAT	MATURE	ALL
WAP	1976	M	M	M	M	M	M	M	M	M	M
WAP	1977	M	M	M	M	M	M	M	M	M	M
WAP	1978	M	M	M	M	M	M	17.5	36.1	10.1	46.2
WAP	1979	M	M	M	M	M	M	16.5	34.0	19.5	53.5
WAP	1980	M	M	M	M	M	M	16.8	33.2	16.5	49.7
WAP	1981	M	M	M	M	M	M	8.9	16.7	22.2	38.9
WAP	1982	M	M	M	M	M	M	24.8	33.2	14.7	47.9
WAP	1983	M	M	M	M	M	M	39.5	63.3	6.0	69.3

APPENDIX G: ZOOPLANKTON POPULATIONS AND LARVAL CRAPPIE FOOD HABITS

Food for larval fish has frequently been cited as a factor that could influence year-class strength (e.g. Braum 1967; Blaxter 1969). Even if predation is the final cause of death, poor growth or condition of larvae because of insufficient food may be the underlying cause of the mortality (Peterson and Wroblewski 1984). Other factors such as changes in reservoir water levels and densities of planktivorous fishes may influence year-class strength because of their effect on zooplankton production or densities.

Before 1979 zooplankton volumes in the standard meter-net tows were measured so that gross changes in abundance could be monitored and possibly correlated to year-class strength. However, this approach was not useful because the meter net did not capture the smaller individuals that constitute the bulk of the food for small crappie larvae. Therefore, in an attempt to better monitor larval crappie food abundance, zooplankton were sampled with a Wisconsin-style plankton net and food habits were determined for some of the crappie larvae captured on the James River Arm of Table Rock Lake. This appendix summarizes the basic findings of those efforts.

METHODS

Zooplankton

A Wisconsin-style plankton net with 80-micron mesh and 12-cm-diameter opening was used to sample zooplankton each night that meter-net tows were made from 1979-1986 on the Long Creek and James River arms of Table Rock Lake (Appendix Tables G1 and G2). Three vertical 5.5 m tows were made at each end of the study section of the reservoir, usually at the start and finish of meter netting. Zooplankton were also periodically sampled in conjunction with larval fish sampling on several other reservoirs (Appendix Tables G-3 through G-8). Zooplankton were preserved in 5% formalin and

identified and quantified in the laboratory according to methods described by Lind (1979) and Wetzel and Likens (1979). Cladocera were identified to genus, while copepods were identified as nauplii or to suborder for copepodid stages.

Food Habits

Stomach contents were identified from 4- to 10-mm-long crappie larvae captured from 1982-1985 on the James River Arm of Table Rock Lake. Ten larvae (5 in 1985) from each 2-mm size group were usually examined from each date that meter-net tows were made and food items were identified to the lowest taxa possible. Results were expressed as number consumed and percent frequency of occurrence from larvae that contained identifiable food. In addition, crappie larvae were captured during the daytime on two dates in 1984 so that food habits of day versus night could be compared (Appendix Table G-9).

Food items of larvae were compared to zooplankton samples with a linear food selection index (L) where $L = r_i - p_i$ and r_i = the percentage of a given food item in the stomachs and p_i = the percentage of that item in the environment (Strauss 1979). Linear food selection indices can range from -1.00 to +1.00 with positive values indicating selection for a given food item. Indices were calculated for copepod nauplii, copepodids, and cladocerans from crappie larvae collected at night. Rotifers were not included because they could not be counted in the guts on most dates.

RESULTS

The major components of the zooplankton communities were the cladocerans Diaphanosoma, Daphnia, and Bosmina; cyclopoid and calanoid copepodids; copepod nauplii; and rotifers. Zooplankton densities were highly variable among reservoirs, years, and nights (Appendix Tables G-1 through G-8).

On the James River Arm of Table Rock Lake, crappie larvae from 4.0-5.9 mm long ate primarily copepod nauplii and copepodids, while larger larvae consumed copepodids and cladocerans (Appendix Table G-9). While some Daphnia, Bosmina, and Diaphanosoma were found in the stomachs, most cladocerans could not be identified to genus. Rotifers or their eggs were found in crappie larvae on 7 of the 13 days examined and usually coincided with high rotifer densities from the plankton samples (Appendix Tables G-1 and G-9). Except that rotifers apparently were easier to identify and count in larvae captured during the day, stomach contents were similar for larvae captured during day and night.

Linear food selection indices for copepod nauplii were generally positive for larvae from 4.0-5.9 mm long and negative for larger larvae. For all three size groups of larvae the indices were positive for copepodids and negative for cladocerans (Appendix Table G-10 and Figure G-1).

DISCUSSION

Zooplankton densities calculated from the vertical tows probably reflected the major changes in the zooplankton community. Even though densities were variable, they were generally in the range reported for other Ozark reservoirs (Applegate and Mullan 1967). Some of the yearly variations may have been caused by annual differences in springtime water temperatures, which would cause some taxa like Daphnia to peak at different times each year.

The food habits of crappie larvae less than 10 mm long from the James River Arm of Table Rock Lake were probably similar to those from other waters where small larvae ate both copepod nauplii and copepodids (Siefert 1969). Even though electivity indices for cladocerans were always negative, larvae consumed relatively large numbers of them in

Appendix Table G-1. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on the James River Arm of Table Rock Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS								COPEPODS								
	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
4-23-79	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.9	0.8	0.0	0.4	1.2	2.1	0.8	0.0	0.0	2.9
5-01-79	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.4	0.2	0.0	0.3	0.5	0.9	0.3	0.0	0.0	1.3
5-08-79	0.0	0.1	0.2	0.1	0.0	0.2	0.0	0.7	0.5	0.0	0.5	1.0	1.7	1.9	0.0	0.0	3.7
5-14-79	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.6	1.2	0.0	0.3	1.5	2.1	1.5	0.1	0.0	3.7
5-23-79	0.4	0.0	0.3	0.4	0.3	0.0	0.0	1.4	0.4	0.0	0.2	0.6	2.0	0.7	0.1	0.0	2.8
5-30-79	1.6	0.0	6.9	3.8	0.0	0.1	0.0	12.5	3.9	0.2	0.7	4.8	17.3	0.9	0.1	0.0	18.3
6-05-79	7.2	0.0	12.8	16.7	0.0	0.1	0.0	36.8	3.4	0.2	1.5	5.0	41.8	21.0	0.2	0.0	63.0
4-15-80	0.1	0.0	1.2	0.3	0.0	0.0	0.0	1.7	1.2	0.1	0.7	1.9	3.6	1.0	0.0	0.0	4.7
4-29-80	0.0	0.1	0.2	0.3	0.0	0.0	0.0	0.6	5.6	0.0	1.5	7.1	7.7	1.4	0.0	0.0	9.1
5-07-80	0.1	0.0	2.5	0.2	0.0	0.0	0.0	2.8	7.0	0.0	1.5	8.5	11.3	1.7	0.1	0.0	13.1
5-14-80	0.1	0.0	0.5	0.6	0.0	0.0	0.0	1.2	2.7	0.0	0.2	2.9	4.1	1.1	0.0	0.0	5.2
5-21-80	0.2	0.0	2.0	0.2	0.0	0.0	0.0	2.4	2.6	0.0	0.2	2.8	5.2	0.4	0.0	0.0	5.6
6-03-80	12.5	0.0	1.9	2.0	0.0	0.0	0.0	16.5	1.7	0.1	0.4	2.3	18.8	7.3	0.1	0.0	26.1
5-11-81	0.6	0.0	6.5	1.9	0.0	0.0	0.0	9.0	4.0	0.1	1.5	5.7	14.7	2.3	0.1	0.0	17.2
5-18-81	1.8	0.0	0.6	0.6	0.0	0.0	0.0	3.0	0.5	0.1	0.5	1.1	4.1	2.1	0.0	0.0	6.3
5-27-81	3.1	0.0	3.7	1.7	0.0	0.0	0.0	8.5	0.8	0.2	1.5	2.5	10.9	0.4	0.1	0.0	11.5
6-01-81	4.6	0.0	5.0	1.1	0.0	0.0	0.0	10.7	2.5	0.2	1.8	4.6	15.3	1.7	0.1	0.0	17.0

Appendix Table G-1. (continued)

MEAN NUMBER OF ORGANISMS PER LITER

	CLADOCERANS								COPEPODS								
DATE	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
5-17-82	0.1	0.0	5.4	17.5	0.0	0.0	0.0	23.1	11.0	0.4	2.8	14.1	37.3	2.8	0.1	0.0	40.1
5-25-82	0.4	0.0	7.3	6.9	0.0	0.0	0.0	14.7	5.1	0.5	2.3	7.8	22.5	1.2	0.1	0.0	23.8
5-31-82	17.3	0.1	13.6	12.3	0.0	0.3	0.3	43.8	17.1	1.1	2.8	21.1	64.9	16.2	0.1	0.0	81.3
5-17-83	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.3	0.8	0.0	1.0	1.8	2.1	10.4	0.0	0.0	12.6
5-24-83	0.0	0.2	0.6	0.8	0.0	0.0	0.0	1.6	1.7	0.0	1.8	3.5	5.1	32.5	0.1	0.0	37.8
5-30-83	0.0	0.3	1.0	1.7	0.0	0.0	0.0	3.0	2.1	0.1	3.7	5.9	8.9	53.2	0.3	0.0	62.4
5-07-84	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.4	0.0	0.6	1.0	1.2	23.5	0.0	0.0	24.7
5-15-84	0.0	0.2	0.9	0.3	0.0	0.0	0.0	1.4	1.7	0.0	2.3	4.0	5.4	70.3	0.0	0.0	75.8
5-21-84	0.1	0.2	2.5	2.0	0.1	0.0	0.0	4.9	2.8	0.0	3.8	6.6	11.5	160.7	0.2	0.0	172.4
5-30-84	2.5	0.3	5.0	7.9	0.1	0.0	0.1	16.0	3.8	0.0	6.8	10.6	26.6	56.3	0.1	0.0	83.0
6-04-84	4.4	0.1	10.0	15.0	0.0	0.1	0.0	29.6	4.8	0.1	8.4	13.3	42.9	68.5	0.1	0.0	111.5
5-07-85	0.2	0.5	0.6	2.3	0.1	0.1	0.0	3.8	3.8	0.0	4.1	7.9	11.7	158.8	0.1	0.0	170.6
5-22-85	17.7	0.6	9.2	10.1	0.0	0.5	0.0	38.1	3.0	0.5	13.2	16.8	54.8	157.5	0.0	0.0	212.3
6-05-85	8.4	0.0	3.9	3.8	0.0	0.0	0.0	16.2	3.6	0.5	5.5	9.6	25.8	158.8	0.0	0.0	184.6
6-06-85	8.4	0.0	1.3	1.4	0.0	0.1	0.0	11.2	1.5	0.4	2.8	4.7	15.9	126.2	0.0	0.0	142.1
5-15-86	0.7	0.0	6.7	10.9	0.0	0.0	0.0	18.4	6.4	0.3	9.9	16.6	35.0	37.5	0.0	0.0	72.5
6-11-86	10.7	0.0	0.6	1.1	0.0	0.0	0.0	12.4	2.6	0.3	3.2	6.0	18.4	46.6	0.0	0.0	65.0

Appendix Table G-2. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on the Long Creek Arm of Table Rock Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS								COPEPODS								
	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
4-22-79	0.0	0.0	6.8	11.6	0.0	0.0	0.0	18.5	7.2	0.2	2.7	10.1	28.6	27.6	0.0	0.0	56.2
5-07-79	0.0	0.0	13.9	5.0	0.0	0.0	0.0	19.0	10.5	0.1	2.9	13.6	32.6	14.0	0.1	0.0	46.6
5-15-79	0.1	0.0	8.9	3.0	0.0	0.0	0.0	12.0	12.3	0.6	2.6	15.5	27.5	21.0	0.0	0.0	48.5
5-22-79	0.5	0.0	18.5	3.2	0.0	0.1	0.1	22.3	7.3	1.1	1.0	9.4	31.7	8.7	0.0	0.0	40.4
5-31-79	0.8	0.0	6.9	3.2	0.0	0.0	0.1	11.1	4.3	2.1	2.1	8.5	19.6	10.2	0.0	0.0	29.8
6-04-79	1.0	0.0	5.0	0.8	0.0	0.0	0.0	6.9	6.7	1.8	3.4	11.8	18.7	5.2	0.0	0.0	23.8
5-06-80	0.0	0.0	8.7	7.1	0.0	0.0	0.0	15.8	5.1	2.4	1.1	8.6	24.4	2.3	0.0	0.0	26.7
5-15-80	0.1	0.0	7.5	4.9	0.0	0.0	0.0	12.5	3.9	3.2	1.3	8.3	20.8	8.4	0.1	0.0	29.2
5-20-80	0.1	0.0	3.8	1.7	0.0	0.0	0.0	5.7	2.7	1.2	0.8	4.7	10.4	2.6	0.0	0.0	13.0
5-29-80	0.9	0.0	7.5	1.8	0.0	0.2	0.0	10.4	2.9	0.8	0.9	4.6	14.9	1.7	0.0	0.0	16.7
6-02-80	1.8	0.0	5.6	0.9	0.0	0.2	0.0	8.5	3.7	0.4	1.0	5.1	13.7	1.2	0.0	0.0	14.9
5-14-81	0.1	0.0	4.8	6.6	0.0	0.0	0.0	11.5	7.5	2.7	1.9	12.1	23.6	2.5	0.0	0.0	26.2
5-19-81	0.1	0.0	3.5	2.3	0.0	0.0	0.0	6.0	4.3	1.8	2.0	8.0	14.0	2.6	0.0	0.0	16.6
5-26-81	0.0	0.0	7.3	0.4	0.0	0.0	0.0	7.8	4.5	1.7	2.8	9.1	16.9	1.7	0.0	0.0	18.6
6-02-81	0.2	0.0	11.0	0.9	0.0	0.1	0.0	12.2	3.7	0.7	2.5	6.9	19.1	1.1	0.0	0.0	20.2
5-18-82	0.0	0.0	0.9	7.7	0.0	0.0	0.0	8.7	9.3	0.8	2.3	12.4	21.1	6.9	0.0	0.0	28.0
5-24-82	0.2	0.0	2.1	4.1	0.0	0.0	0.0	6.5	3.3	1.4	2.0	6.7	13.2	2.8	0.0	0.0	16.0
6-01-82	0.0	0.0	3.6	1.9	0.0	0.0	0.1	5.6	3.5	1.8	2.9	8.2	13.8	7.4	0.0	0.0	21.2

Appendix Table G-2. (continued)

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	COPEPODS CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
5-18-83	0.1	0.2	24.1	1.4	0.0	0.1	0.0	25.9	6.3	1.0	15.9	23.3	49.2	23.0	0.0	0.0	72.2
5-23-83	0.0	0.1	16.1	2.0	0.0	0.3	0.0	18.5	4.9	0.7	10.0	15.6	34.1	48.7	0.0	0.0	82.8
5-31-83	0.0	0.1	9.2	2.1	0.0	0.3	0.1	11.8	3.6	1.6	6.3	11.5	23.4	28.4	0.0	0.0	51.8
5-08-84	0.0	0.2	7.1	4.5	0.0	0.0	0.0	11.8	12.4	0.6	32.9	45.9	57.7	88.7	0.0	0.0	146.5
5-14-84	0.0	0.1	20.8	1.5	0.0	0.0	0.0	22.5	22.2	1.3	14.9	38.5	60.9	126.8	0.0	0.0	187.7
5-22-84	0.0	0.2	13.8	3.7	0.0	0.0	0.0	17.7	5.2	1.0	9.9	16.1	33.8	100.3	0.0	0.0	134.1
5-29-84	0.0	0.1	6.4	0.2	0.1	0.0	0.1	6.8	3.2	2.8	7.9	13.8	20.7	27.8	0.0	0.0	48.5
6-05-84	0.5	0.0	3.7	0.9	0.0	0.1	0.2	5.3	2.2	1.3	8.9	12.5	17.8	30.9	0.0	0.1	48.8
5-21-85	0.0	0.0	6.4	0.0	0.0	0.0	0.4	6.8	5.4	1.8	14.6	21.8	28.6	42.1	0.0	0.0	70.7
6-05-85	0.2	0.0	3.5	0.0	0.0	0.0	0.2	3.9	11.0	1.0	19.0	30.9	34.8	28.0	0.0	0.0	62.8
5-15-86	0.1	0.0	7.8	16.9	0.0	0.0	0.0	24.8	7.6	1.7	7.4	16.7	41.5	28.0	0.0	0.0	69.5
6-12-86	0.3	0.0	7.2	1.0	0.0	0.0	0.0	8.5	5.6	1.7	4.5	11.8	20.4	16.3	0.0	0.0	36.6

Appendix Table G-3. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on the Niangua Arm of Lake of the Ozarks. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS								COPEPODS								
	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
4-24-79	0.1	0.0	0.7	1.6	0.0	0.0	0.0	2.4	12.4	0.3	2.5	15.2	17.5	0.5	0.0	0.0	18.1
5-10-79	0.2	0.0	4.9	3.1	0.0	0.0	0.0	8.2	2.8	0.1	2.1	5.0	13.2	8.6	0.0	0.0	21.8
5-22-79	0.2	0.0	12.1	5.6	0.0	0.2	0.0	18.1	9.4	7.5	2.7	19.7	37.8	1.4	0.1	0.0	39.3
5-29-79	0.8	0.0	12.2	9.7	0.0	0.2	0.1	22.9	10.2	2.0	2.0	14.2	37.1	1.9	0.1	0.0	39.2
6-18-79	1.8	0.0	5.9	0.2	0.0	0.0	0.1	8.0	7.0	1.3	1.2	9.4	17.5	1.7	0.1	0.0	19.3
5-08-80	0.2	0.0	10.7	3.5	0.0	0.0	0.0	14.5	12.4	1.3	1.1	14.8	29.2	11.5	0.0	0.0	40.8
5-13-80	0.2	0.0	17.7	7.5	0.0	0.0	0.1	25.5	15.4	0.7	1.7	17.9	43.4	2.1	0.1	0.0	45.6
5-27-80	3.0	0.0	13.4	3.4	0.0	0.0	0.2	20.0	16.5	0.5	1.6	18.6	38.7	19.9	0.1	0.0	58.6
6-11-80	11.4	0.0	3.7	4.7	0.0	0.2	0.2	20.1	16.1	1.9	9.6	27.6	47.8	3.6	0.1	0.0	51.4
6-03-83	0.1	0.0	6.8	2.9	0.0	0.0	0.0	9.8	5.4	0.8	15.2	21.4	31.2	64.1	0.0	0.0	95.3
6-08-84	1.2	0.0	4.3	1.2	0.0	0.0	0.1	6.7	2.7	1.3	11.4	15.4	22.2	52.1	0.0	0.0	74.3
6-17-85	1.5	0.0	0.6	0.1	0.0	0.0	1.3	3.4	11.9	2.0	13.0	26.9	30.3	283.8	0.1	0.0	314.1
5-22-86	0.9	0.0	1.8	0.2	0.0	0.0	0.0	2.9	4.4	2.7	10.3	17.4	20.3	6.0	0.0	0.0	26.3
6-10-86	2.6	0.0	8.5	0.1	0.0	0.0	0.0	11.2	11.0	1.7	14.6	27.3	38.6	8.8	0.0	0.0	47.4

Appendix Table G-4. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on Pomme de Terre Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night. The high number of "other" organisms found in 1985 were unattached rotifer eggs).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	COPEPODS CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
6-12-85	0.4	0.0	0.6	0.0	0.0	0.0	0.1	1.1	2.5	1.9	10.3	14.7	15.8	37.6	0.0	383.7	437.1
6-13-85	0.3	0.0	1.1	0.0	0.0	0.0	0.2	1.7	2.0	0.9	10.6	13.5	15.1	38.9	0.0	191.9	246.0
5-12-86	0.4	0.0	22.3	0.3	0.0	0.0	0.0	23.0	9.1	7.6	11.0	27.7	50.8	28.6	0.0	0.0	79.3
6-02-86	0.5	0.0	8.4	0.0	0.0	0.0	0.0	8.8	19.5	3.0	18.2	40.8	49.6	3.7	0.0	0.0	53.3

Appendix Table G-5. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on the Sac Arm of Stockton Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS								COPEPODS								
	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
6-06-84	0.0	0.0	5.4	0.1	0.0	0.0	0.1	5.6	0.1	1.3	3.3	4.7	10.3	174.2	0.0	0.0	184.4
5-13-85	0.1	0.5	12.0	0.5	0.0	0.2	0.8	14.0	2.1	3.1	10.4	15.6	29.6	427.6	0.0	0.0	457.2
6-11-85	0.2	0.0	9.0	0.0	0.0	0.2	0.1	9.4	0.6	2.1	6.8	9.5	18.9	77.9	0.0	0.0	96.9
5-13-86	0.3	0.0	7.0	0.0	0.0	0.0	0.0	7.3	2.9	4.0	7.8	14.8	22.1	40.9	0.0	0.0	63.0
6-03-86	0.3	0.0	13.1	0.1	0.0	0.0	0.0	13.5	4.2	5.2	16.1	25.6	39.1	105.0	0.0	0.0	144.1

Appendix Table G-6. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on Thomas Hill Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	COPEPODS CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
6-12-84	0.1	0.0	3.3	1.7	0.0	0.0	0.0	5.1	2.3	3.3	5.6	11.1	16.2	1.7	0.0	0.0	17.9
5-28-85	2.8	0.0	10.5	8.2	0.0	0.0	0.0	21.5	8.0	18.3	50.1	76.4	97.9	146.1	0.0	0.0	244.0
5-20-86	0.0	0.0	5.0	14.0	0.0	0.0	0.0	19.0	11.7	0.9	23.4	36.0	55.0	80.8	0.0	0.0	135.8
6-05-86	0.3	0.0	5.7	2.6	0.0	0.0	0.0	8.7	6.9	1.8	13.1	21.8	30.5	67.4	0.0	0.0	97.8

Appendix Table G-7. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on Harry S. Truman Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

DATE	CLADOCERANS DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	COPEPODS CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
6-11-84	2.0	0.0	12.4	4.7	0.0	0.0	0.0	19.1	6.8	9.9	15.0	31.7	50.8	5.3	0.0	0.0	56.1
6-19-84	3.8	0.0	19.8	10.7	0.0	1.4	0.0	35.7	17.0	20.2	27.3	64.5	100.1	7.4	0.0	0.0	107.5

Appendix Table G-8. Zooplankton densities (number per liter) estimated from 5.5 meter vertical tows collected in conjunction with larval fish sampling on Smithville Lake. (Three vertical tows were typically made at each end of the meter-net study areas each night).

MEAN NUMBER OF ORGANISMS PER LITER

	CLADOCERANS								COPEPODS								
DATE	DIAP	CHYD	DAPH	BOSM	PLEU	CERI	OTHER CLAD	TOTAL CLAD	CYCL	CALA	NAUP	TOTAL COPE	TOTAL CLAD &COPE	ROTI	DIPT	OTHER	GRAND TOTAL
6-18-85	2.9	0.0	4.8	14.0	0.0	0.3	0.0	22.1	4.3	4.6	16.7	25.5	47.6	86.0	0.0	0.0	133.5

Appendix Table G-9. Food habits of larval crappie captured in the James River Arm of Table Rock Lake. (Percent frequency is from fish that contained identified food items. "P" indicates that the item was present but the frequency was not determined).

					Food Items									
									Copepods					
			Number	Number With	Rotifers		Rotifer Eggs		Nauplii		Copepodids		Cladocerans	
Date	Size Group	Number Examined	With Food	Identified Items	Number Eaten	Percent Frequency	Number Eaten	Percent Frequency	Number Eaten	Percent Frequency	Number Eaten	Percent Frequency	Number Eaten	Percent Frequency
5-17-82	4	10	10	3	-	-	-	-	-	-	9	100	-	-
5-17-82	6	11	10	10	-	-	-	-	1	10	80	100	1	10
5-17-82	8	16	16	14	-	-	-	-	-	-	132	100	1	7
5-17-82	10	5	5	5	-	-	-	-	-	-	128	100	5	40
5-25-82	4	11	10	9	-	-	-	-	43	89	10	56	-	-
5-25-82	6	10	10	10	-	-	-	-	13	60	93	100	4	40
5-25-82	8	10	10	10	-	-	-	-	-	-	130	100	8	50
5-31-82	4	13	10	7	-	-	-	-	9	86	5	43	1	14
5-31-82	6	10	10	10	-	-	-	-	1	10	34	70	32	80
5-31-82	8	10	10	10	-	-	-	-	-	-	29	80	69	100
5-17-83	4	3	3	0	-	-	-	-	-	-	-	-	-	-
5-24-83	4	8	6	1	-	-	-	P	1	100	2	100	-	-
5-24-83	6	4	4	4	-	-	-	P	3	50	14	100	-	-
5-30-83	4	10	9	6	-	100	-	100	9	17	16	50	-	-
5-30-83	6	10	10	10	24	20	-	60	1	10	67	80	-	-
5-30-83	8	2	2	2	4	50	-	50	-	-	10	100	-	-
5-15-84	4	5	5	2	-	-	21	100	-	-	-	-	-	-
5-15-84	6	1	1	1	-	-	33	100	-	-	7	100	-	-
5-21-84	4	10	10	10	-	40	110	80	38	90	8	40	-	-
5-21-84	6	10	10	10	-	40	42	70	11	60	55	90	-	-
5-21-84	8	9	9	9	-	56	162	100	-	-	52	89	1	11

Appendix Table G-9. (continued)

Date	Size Group	Number Examined	Number With Food	Number With Identified Items	Rotifers Number Eaten	Rotifers Percent Frequency	Rotifer Eggs Number Eaten	Rotifer Eggs Percent Frequency	Copepods: Nauplii Number Eaten	Copepods: Nauplii Percent Frequency	Copepods: Copepodids Number Eaten	Copepods: Copepodids Percent Frequency	Cladocerans Number Eaten	Cladocerans Percent Frequency
5-21-84	4	10	10	10	55	80	152	100	3	20	9	50	-	-
(Day)	6	10	10	10	97	90	146	90	1	10	30	70	-	-
	8	6	6	6	124	100	136	100	-	-	23	83	1	17
5-30-84	4	9	9	9	-	22	-	-	51	89	50	78	-	-
5-30-84	6	10	10	10	-	-	-	-	2	20	105	100	7	30
5-30-84	8	10	10	10	-	-	-	-	-	-	131	100	31	70
5-30-84	4	7	6	5	-	-	-	-	8	60	13	100	-	-
(Day)	6	10	10	10	2	10	-	-	14	50	20	70	5	20
	8	10	10	10	-	-	-	-	-	-	20	50	17	80
6-04-84	4	10	9	8	-	12	52	50	37	88	15	62	-	-
6-04-84	6	10	10	10	-	-	57	40	49	90	27	100	2	20
6-04-84	8	10	10	10	-	-	-	-	10	20	118	90	11	30
5-22-85	4	5	5	5	-	-	-	-	13	40	3	60	8	60
5-22-85	6	5	5	5	-	-	-	-	-	-	29	100	7	60
5-22-85	8	5	5	5	-	-	-	-	-	-	11	60	47	100
6-05-85	4	5	5	5	-	60	4	20	6	20	1	20	10	100
6-05-85	6	5	5	5	-	-	-	-	3	40	4	40	33	100
6-05-85	8	5	5	5	-	-	-	-	-	-	4	40	48	100
6-06-85	4	5	5	5	-	-	-	-	1	20	-	-	29	100
6-06-85	6	5	5	5	-	-	-	-	1	20	1	20	34	100
6-06-85	8	5	5	4	-	-	-	-	-	-	-	-	48	100

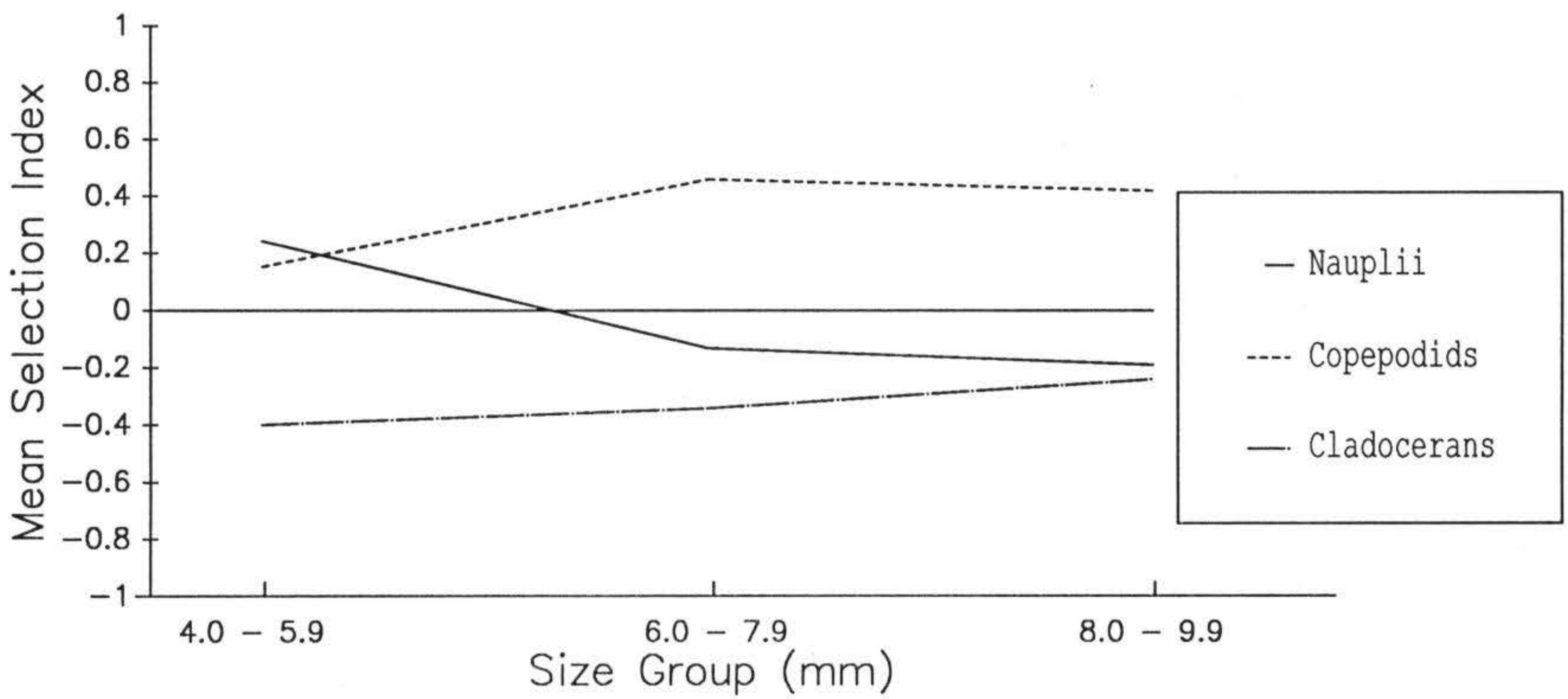
Appendix Table G-10. Larval crappie linear selection indices of major food groups for fish captured at night from 1982-1985 on the James River Arm of Table Rock Lake.

		Linear Selection Indices by Size Groups (mm)		
Date	Food Item	4.0-5.9	6.0-7.9	8.0-9.9
5/17/82	Nauplii	-0.07	-0.06	-0.07
	Copepodids	0.69	0.67	0.68
	Cladocerans	0.62	-0.61	-0.61
5/25/82	Nauplii	0.71	0.02	-0.10
	Copepodids	-0.06	0.59	0.69
	Cladocerans	-0.65	-0.61	-0.59
5/31/82	Nauplii	0.56	-0.03	-0.04
	Copepodids	0.05	0.23	0.02
	Cladocerans	-0.61	-0.20	0.02
5/24/83	Nauplii	-0.02	-0.17	----
	Copepodids	0.34	0.49	----
	Cladocerans	-0.32	-0.32	----
5/30/83	Nauplii	-0.06	-0.41	-0.42
	Copepodids	0.39	0.74	0.75
	Cladocerans	-0.33	-0.33	-0.33
5/15/84	Nauplii	----	-0.42	----
	Copepodids	----	0.68	----
	Cladocerans	----	-0.26	----
5/21/84	Nauplii	0.51	-0.15	-0.32
	Copepodids	-0.07	0.59	0.74
	Cladocerans	-0.44	-0.44	-0.42
5/30/84	Nauplii	0.27	-0.21	-0.23
	Copepodids	0.33	0.75	0.64
	Cladocerans	-0.60	-0.54	-0.41
6/04/84	Nauplii	0.51	0.43	-0.13
	Copepodids	0.18	0.24	0.74
	Cladocerans	-0.69	-0.67	-0.61
5/22/85	Nauplii	0.30	-0.24	-0.24
	Copepodids	0.07	0.74	0.13
	Cladocerans	-0.37	-0.50	0.01
6/05/85	Nauplii	0.14	-0.13	-0.21
	Copepodids	-0.10	-0.06	-0.08
	Cladocerans	-0.04	-0.19	0.29

Appendix Table G-10. (cont.)

Date	Food Item	Linear Selection Indices by Size Groups (mm) 4.0-5.9	6.0-7.9	8.0-9.9
6/06/85	Nauplii	-0.15	-0.15	-0.18
	Copepodids	-0.12	-0.09	-0.12
	Cladocerans	0.27	0.24	0.30

Appendix Figure G-1. Mean linear selection indices of 3 major food groups for larval crappie from 4 to 10 mm long captured from 1982-1985 on the James River Arm of Table Rock Lake.



some years (Appendix Table G-9). Cladocerans have been found to be important food items for larvae 8 mm and longer (Siefert 1969).

One objective of this part of the study was to determine if early mortality of crappie larvae could be related to major changes in either zooplankton populations or food habits. Based upon these observations, it is difficult to determine if food was a problem for small crappie larvae in any of the years examined. Even though zooplankton densities varied considerably, most stomachs that were examined contained food and there did not appear to be major changes in consumption among years. Future studies should not only address basic food habits, but also the size of food items consumed by the different size groups of larvae. Densities of other planktivorous fishes (e.g. shad and other larvae) should also be monitored, because they may affect zooplankton composition, density, and possibly availability to larval crappie. Food habits of larvae collected during the daytime should also be determined, because crappie may feed more actively during daylight (Mathur and Robbins 1971) and the organisms in the gut could be more easily identified. Food habits of larger larvae should also be examined.

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